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Illustrated
With a great Variety of COPPER-PLATES, accurately
drawn from Nature, and beautifully engraved.

By the Rev. SAMUEL WARD,
Vicar of Cotterstock, cum Glapthorne, Northamp-
tonshire ; and others.

V O L. XII.

*The great Creator did not bestow so much Curiosity and
Workmanship upon his Creatures to be looked upon with a
careless incurious Eye.*

Cerham's Phys. Theol. Book xi.

L O N D O N :

Printed for F. NEWBERRY, the Corner of St. Paul's
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MODERN SYSTEM

OF
ART AND HISTORY



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Edw
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OF
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M DCC LXXVI.

THE
NATURAL HISTORY

WATER, EARTH, FOSSILS,
MINERALS AND VEGETABLES

BY
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LONDON:
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THE
NATURAL HISTORY
OF
WATERS, EARTHS, FOSSILS,
MINERALS AND VEGETABLES.

OF THE EARTH AND WATERS.

IF we examine into the internal composition of the earth, we shall find, where it has been opened to any depth, it consists of different layers or beds, lying horizontally one over the other, like the leaves of a book; each of them composed of materials that increase in weight in proportion as they lie deeper. A very small part of the internal composition of the earth has been the subject of human examination. The mine of Cotteberg, in Hungary, which is supposed to be the deepest in the world, is not above three thousand feet

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in depth. How insignificant is this, compared to the depth of the terrestrial globe, down to the centre, which is above four thousand miles!

The first layer at the surface of the earth, is generally that light coat of blackish mould, sometimes called garden earth. This seems to have been formed from animal and vegetable bodies decaying, and thus turning into its substance. It serves again as a store-house, from whence animal and vegetable nature are renewed; and thus are all vital blessings continued with unceasing circulation. It is this external covering that supplies man with all the real riches he enjoys. Gold and jewels may be brought from greater depths, but these are toys on which he has placed an imaginary value; and for which fools only part with the more substantial blessings of life.

This earth, says Pliny, like a kind mother, receives us at our birth, and sustains us when we are born. It is the only element around us that is never found an enemy to man. The body of waters deluge him with rains, oppress him with hail, and drown him with inundations. The air rushes in storms; prepares the tempest, or kindles the volcano;

cano ; but the indulgent earth enamels his walks with flowers, spreads his table with plenty, and returns with interest every good committed to her care. Though she produces the poison, she supplies the antidote, and continues her kind indulgence to man even to the last : when life is over, she receives his remains, and benevolently shelters them in her bosom.

Descending from the surface, if we view the earth cut perpendicularly downwards, we shall find its layers regularly disposed in their proper order. Indeed they are not all of the same kind and thickness in every place, as they differ in different soils and situations. Marle is sometimes found over sand, and sometimes under it. The most common disposition is, that under the first earth is formed gravel or sand, then clay or marle, after that chalk or coal, marbles, oars, sands, gravels, and thus an alternation of these substances, each growing more dense as it sinks deeper.

If we could descend into the bowels of the earth, we should there see dark chambers and apartments, strange subterraneous passages, holes, and caverns ; some filled with smoke and fire, some
with

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with water, and some with vapour and mouldy air; little brooks running murmuring through the dark grottos. A surprizing mixture of substances are also found in the internal parts of the earth; masses of petrified wood, brick, wrought metals, beds of sea-shells, trees, and marine bodies; and these not in particular places, but throughout the whole earth; not only in the lower grounds, and hills near the shore, but in the highest mountains far distant from the sea, and from the surface of the earth.

These marine substances, so commonly diffused, and so generally to be met with, were long considered by philosophers as productions of the earth, and not of the sea; but, upon a closer enquiry, they were obliged to alter their opinion. It appeared that these shells had, in every respect, the properties of animal and not of mineral nature. They were found exactly of the same weight with their fellow shells upon shore; and they answered all the chemical trials in the same manner as sea-shells do. Their parts, when dissolved, had the same appearance, the same smell, and the same taste. They had also the same effects when inwardly administered; from these

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considerations, therefore, they were admitted to have originated from the sea; the difficulty remaining was, how to account for their coming so far from their own natural element upon land. Various have been the conjectures on this subject: but they have generally been thought the effects of some great event, some terrible change in nature.

We learn in Scripture, that God caused an inundation to be brought upon the earth in the days of Noah, for the punishment of a wicked world, that overspread the face of the whole earth; and in such excess, that the floods overreached the tops of the highest mountains; insomuch, that a general destruction and devastation was brought upon the earth and its inhabitants. The amazing agitation and fluctuation of the vast waves, rolling for many months together on the outward frame of the earth, must have made strange havock, levelling vast mountains, and raising others. This universal disorder might occasion that mixture of bones and animals, masses of broken metals, and sundry works of human art, together with the shells and teeth of fishes, and other productions of the sea. Many parts of the
earth

earth may have been undermined by the raging waves, and the mountains in many places may have tumbled down on the plains; burying under their ruins those marine bodies, which were intercepted by this fall. Earthquakes indeed produce the like effects, making strange havock upon the face of the earth, and turning things upside down: but we do not read, that there have been such frequent and universal repetitions of these dismal events, to infer, that they have thus turned the earth, as it were, inside out: and as things of this nature excite great attention and admiration when they happen, they would certainly have been transmitted down to the remotest posterity.

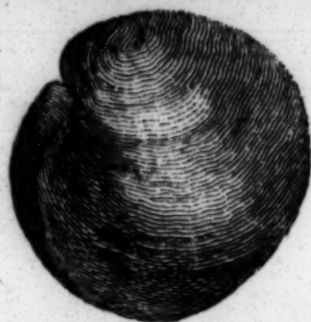
An Italian, quoted by Mr. Buffon, supposes these marine substances to have been deposited in the earth at the time of the crusades, by the pilgrims who returned from Jerusalem; who, gathering them upon the sea-shore in their return, carried them to their different places of habitation. But this conjecturer forms a very inadequate idea of their numbers. At Touraine, in France, upwards of an hundred miles from the sea, there is a plain about twenty-seven leagues in circumference.

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umference, entirely composed of shells of various kinds, without the smallest portion of earth between them. Near Reading *, in Berkshire, for many succeeding generations, a continued body of oyster-shells have been found, through the whole circumference of five or six acres of ground. These shells are in their natural state, but they are also found petrified, and in great abundance in all the Alpine rocks, in the Pyrenees, on the hills of France, England, and Flanders.

In many parts of Asia and Africa, these shells have been found in great abundance. In the mountains of Castravari, near Barut, they quarry out a white stone, every part of which contains petrified fishes in great numbers, and of surprizing diversity. They are in such excellent preservation, that their fins, scales, and the minutest distinctions of their form, are distinctly perceived. One of the Pyramids of Egypt is entirely built of a kind of free-stone, in which there are found great quantities of these petrified shells. As we have accounts, that these pyramids were built long before the age of Herodotus, who lived

* Phil. Transf. vol. ii. p. 427.

but

but fifteen hundred years after the flood, it may be conjectured, that they were erected but a short time after the flood. It cannot be supposed that the marine substances found in one of them, had time to be formed into a part of the solid stone, either during the deluge, or immediately after it; therefore their putrefaction must have been before that period. Mr. Buffon has given specious reasons to prove, that such shells were deposited, not only before the deluge, but even antecedent to the formation of man; when the whole earth, as he supposes, was buried under the waters.

Dr. Goldsmith also hazards a conjecture, that instead of supposing these substances to be the remains of animals belonging to the sea, he would consider them as bred in the numerous fresh water lakes, that, in primæval times, covered the face of uncultivated nature.

To continue our survey of the earth, we must remember that the land and water, taken together, make one globular body, which is evident from many observations of person's standing on the shore, and viewing a ship departing from the port. They gradually lose sight of the lower part of the vessel, whilst they
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Of the EARTH and WATERS. 13

can still behold the rigging and the streamers at the top; but as the ship proceeds, they lose sight of these also, as if the whole was sunk into the deep; in like manner, when a ship is making to land, the mariners first descry the tops of steeples, trees, &c. pointing above the water; the buildings appear next in view, and last of all the shore, which can only be the effect of the earth's rotundity.

The globularity of the earth is also evinced in a lunar eclipse, which is occasioned by the interposition of the earth between the sun and moon; the earth's shadow being reflected on the moon always appears circular, and it is an indisputable fact, that bodies reflect a shadow similar to their own shapes; thus a square substance opposed to the light, produces a square shadow; a triangular one causes a triangle. If the earth was a flat extended plane, like a round table, its shadow on the moon would appear like a straight line. It is therefore obvious, that the earth's shadow being round, the earth itself must be globular; and, though there are vallies and mountains on its surface, these inequalities are as inconsiderable, when compared to the magnitude of the earth, as the little asperities

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on the rind of an orange; and accordingly we find, that mountains and valleys upon the surface of the earth, cause no irregularities in its shadow; for in a lunar eclipse, the circumference is reflected even and regular, as if it were produced by a body exactly globular.

The semidiameter of the earth is above eight thousand English miles; the highest mountain is but four miles higher than the surface of the sea, which is but a two thousandth part of the earth's diameter; thus it appears, that the highest mountain bears no greater proportion to the bulk of the earth, than a grain of dust does to a common globe. The roundity of the earth is also confirmed by many voyages which have been made about it from East to West. First by Magellan's ship, in the years 1519, 1520, and 1521, in 1124 days. By Sir Francis Drake in the years 1577, 1578, 1579, and 1580, in 1056 days. By Lord Anson, who on the 15th of June, 1744, finished his long voyage of near four years. By Commodore Byron, Captain Wallis, Carteret, &c. and lastly, by Captain Cook, accompanied by Mr. Banks and Dr. Solander, in the years
1769,

1769, 1770, 1771, who severally circumnavigated the globe.

Having thus far treated on the earth, we shall direct our enquiries to the waters. The general term, waters, implies a pellucid fluid, convertible into ice by cold; naturally pervading the strata of the earth, and flowing or stagnating on its surface.

Pure water would require a definition very different from this, that of a limpid and colourless liquor, without smell or taste, simple and volatile. But such a definition would not include the waters impregnated with metalline, stony, saline, and other fossile particles.

Waters may be arranged under two general divisions: 1. The common waters; serving for the ordinary purposes of life. 2. The waters impregnated with peculiar mineral substances. The differences of common water, arising from the circumstances of stagnation or motion, or of its containing more or less of those stony particles, which it always contains in some degree, are not so essential, as to prevent the whole from being considered as of only one kind.

On the other hand, the waters impregnated with peculiar mineral substances,

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differ essentially in regard to the several impregnating matters, and are properly arranged into four kinds: 1. Waters impregnated with metalline particles. 2. Waters impregnated with saline particles. 3. Waters impregnated with sulphureous particles. 4. Waters impregnated with terrene particles. The waters of the first general kind are used in the common occasions of life, those of the other are taken as medicines to restore decayed health.

Simple water, to use the common phrase, is a pellucid colourless fluid, insipid to the taste, and without smell. We meet with this under different circumstances, and accordingly divide it into spring-water, well-water, river-water, pond-water, rain-water, and snow-water. The first is the water furnished us from the bowels of the earth, and is continually fresh supplied: the second is the same water, only with the difference of its remaining long in the same place before we have it: the third is a mixture of the first, and of fresh vapours raised from the sea and fresh waters, and descending in rains. The two first are almost invariably the same; the latter is subject to a thousand changes, from the
matters

matters accidentally washed into it by the torrents occasioned by the rains ; but it has the advantage of being in continual motion. In its nature, the fourth is much the same with this, but is rather more owing to water that has been raised in vapour, and has fallen again in rain ; this has also the disadvantage of standing and stagnating in its place. The fifth has the advantage of being wholly raised in vapour, and, as it were, distilled by nature ; it is consequently purer than any of the others ; but there are so many kinds of particles, capable of rising with the water in vapour, that it never can be perfectly pure. The last has all the advantage of this, and the additional one of having been frozen in its passage, and thus having passed through an operation, very well calculated for the separating of heterogenities of many kinds. Upon the whole, the last, or snow-water, bids fair for being the purest and fittest for common use, of any that comes in our way ; yet even this we have found, by experiments, not to be entirely pure.

Medicinal Waters are such as, exclusive of the sparry, earthy, and crystalline matter contained in all water, are impregnated with other mineral particles,

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and these either of the metalline or saline kind. These waters are distinguished by two several kinds, as they come forth out of the ground, either hot or cold. The names by which they are called are *thermæ* and *acidulæ*. The name of *thermæ* is properly given to the hot ones, expressing as much ; but the other term, *acidulæ*, is not quite opposite to the cold ones, because they rarely contain an acid salt, but always an alkaline one. It was given them on account of a urinous, or, as some express it, a subacid taste, which many of the cold mineral waters have, when fresh drawn from the spring.

Sea-water, on account of its disagreeable taste, is not often given internally, though great advantages arise from it. It is of great use, however, in bathing ; cutaneous eruptions of almost all kinds are cured by perseverance in the use of it : tumours, and pains of the limbs, are also frequently cured by it ; and we find it often recommended as the great medicine against the most terrible of all diseases, the bite of a mad dog. It is a common error to suppose, that water, with salt dissolved in it, answers the purpose of sea-water. It is said, indeed, that it has answered, in some cases in the
external

external way, by way of bath ; but those people have been much deceived who thought, from the internal use of salt-water, that they supplied its place in a pleasanter manner by drinking common water, with some sea salt dissolved in it.

The benefit which the Almighty designed for man, by the tides, in giving a perpetual motion to the waters, was to prevent their corrupting, and thereby breeding any infection that might arise from too long a stagnation of them. He has not committed this trust to the uncertain care of the winds, which he appointed to purify the air we breathe, and to facilitate the productions of the earth by the diversity of its impressions and influences ; though the winds are not less useful upon the sea, in transporting our merchandize with more ease and expedition than the ablest horses could possibly do by land. Their blasts, however, are very uncertain, and frequently succeeded by long calms, which would breed putrefaction in the sea, that great receptacle, into which all the rivers of the earth discharge themselves. The same gracious being has been pleased to superadd to those irregular and interrupted purgations of the winds, these
diurnal

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diurnal helps of the flux and reflux of the tides, which cause the rivers also to flow back to a certain distance ; by which encrease of waters, large ships of burden are conducted to capital cities, which, without this flowing of the rivers, would be absolutely impracticable.

That water is the most fluid penetrating body, next to fire, and the most difficult to confine, is incontestibly proved by a variety of experiments. A vessel through which water cannot pass, may be said to retain any thing. It is admitted, indeed, that syrups, oils, and honey, leak through some vessels, that water cannot pass through ; but this is owing to the rosin, wherewith the wood of such vessels abounds, which oils and syrups have a power of dissolving. Water, however, will at length find its way even through these ; for it is known to escape through vessels of every substance, glass only excepted.

No fire can make water hotter, after it begins to boil. Boiling water affords a standard fixed degree of heat over the whole world, being as hot in Greenland, as upon the coasts of Guinea : Of heat there are various degrees ; one fire is more intense than another ; but boiling
water

water is an heat every where the same, and easily procurable.

OF CLAY.

CLAY, in natural history, is a genus of earths, the characters of which are these: they are firmly coherent, weighty, and compact; stiff, viscid, and ductile to a great degree, whilst moist; smooth to the touch, not easily breaking between the fingers, nor readily diffusible in water, and when mixed, not readily subsiding from it. Of this genus authors enumerate a great many species, some white, some brown, grey, blue, yellow, green, red, black, &c. Besides the use of clay for making potter's ware, it is a considerable improver of light and sandy grounds, which, unless they are clayed, will bear nothing but rye, with whatever other composts they are manured; but once clayed, they will produce oats, barley, pease, &c. In Yorkshire, they lay an hundred load upon an acre of ground, which will keep the soil in heart, as they term it, upwards of forty years; indeed, the first year after being clayed, it bears rank, ill-coloured, and broad-grained

grained barley ; but afterwards a plump round corn, like wheat.

Clay-lands are those abounding with clay, whether black, blue, yellow, white, &c. of which the black and the yellow are the best for corn. All clay-soils are apt to chill the plants growing on them in moist seasons, as they retain too much water ; in dry seasons, on the contrary, they turn hard and choke the plants. Their natural produce is weeds, goose-grass, large daisies, thistles, docks, poppies, &c. Some clay soils will bear clover and rye-grass ; and if well manured, will produce the best grain : they hold manure the best of all lands, and the most proper for them are horse-dung, pigeon's dung, some kinds of marle, folding of sheep, malt-dust, ashes, chalk, lime, foot, &c.

OF MARLE.

MARLE is a kind of dry, soft, fossil earth, used for manuring of land. The word is derived from the old Celtic *Marga*, mentioned by Pliny. The principal sorts of marle are the white and red. Too much of it thrown on the ground is found to burn it. Marle is burnt like
other

other stone for making of lime. It is a very material circumstance in the marling of land, to find out how much the land requires of this manure; and till experience has thoroughly shewn this, it is better to err in laying on too little than too much; because the latter is a fault not to be remedied. It is to be observed also, that marle never makes so great an improvemet on land the first year, as it does afterwards. In Staffordshire they lay two hundred loads of marle upon an acre of land of the common kind; but where the soil is black, loose, and sandy, or full of worms, they will lay on three or four hundred loads to an acre; it being a rule with them, that this sort of soil cannot be marled too much. If the mould be thin, the less marle is required; if deep, it must have the more. It is best sowing of marled lands under furrow; because if these lands are well husbanded, they will be very mellow and hollow, which will occasion the earth's sinking from the roots of the corn, if it stand too high. If marle fattens land, or makes it stiff, or binding, it must be well dunged, and laid down for grass. In Staffordshire, after their land is marled, their method is to take the crops following.

After

After the first crop of wheat is off, they plow in the wheat stubble in December, and if the weather proves frosty, to mellow it, they do not plow again till April. They then sow it with barley, allowing three bushels of seed to an acre. The common produce of this is thirty bushels. After this they sow pease, for which they plow once in the February following, allowing only three bushels of seed to an acre, as in the barley. Next after this, if they intend six crops, they sow wheat again upon the pease crop; the fifth crop is barley again; and the sixth year's is red oats. Some sow two or three crops more, when the ground has been well marled, but that is much better avoided. In digging for the marle they use in manuring the lands, in Ireland, they meet with fossil horns, and other curious fossils. The marle always lies in the bottom of low bogs. It is never met with in any other places, and is found by boring with augres made for that purpose. It usually lies at five, seven, or nine feet depth. Dice marle, is a name given by the people of Staffordshire to a reddish marle, that breaks into small square pieces like dice, or else into thin flakes,

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in the manner of lead ore, and looks smooth on the surface.

LOAMS.

LOAMS, in Natural History, are defined to be earths, composed of dissimilar particles, hard, stiff, dense, and rough to the touch; not easily ductile while moist, readily diffusible in water, and composed of sand, and a tough viscid clay. Of these loams, some are whitish, and others brown or yellow.

OF OKERS.

LIGHT brittle pale yellow oker is between the colour of brimstone, and what is called a cream colour, and is of a loose crumbly texture, it being composed of very thin fine plates. It is extremely light, and separates into flakes, in the fire, of a dull reddish brown colour. It is found in Pensylvania and Virginia, and with water makes a straw colour, but with oil, a yellow.

Hard heavy pale yellow oker is well known among the painters, and is of a close, compact, firm texture, with a smooth even surface; when burnt in the
C fire

fire it becomes of a dull pale red, and considerably hard. It is found in several parts of Europe, and particularly in Somersetshire.

Light crumbly yellow oker is generally seen at the mouths of the springs of the Spa kind, and at present is made very little use of; nor can it be expected in any large quantities. In the fire it becomes a tolerable good red.

Light brittle gold coloured oker is met with in small lumps in the earth, and is very light, being of a crumbly texture, and stains the hands of a gold colour. It turns to a bright red in the fire, and becomes a little more hard. It is common among gravel in several parts of the kingdom, particularly on Mendip Hills, where it lies in the clefts of the strata.

Light plated saffron coloured oker is sometimes found making a stratum, and sometimes in the perpendicular clefts of other strata, and is of a soft crumbly texture, with a rough and even surface, but colours the hands with a very beautiful yellow. It burns to a dusky red, and is common in Northamptonshire and Staffordshire.

Common yellow oker is a dense heavy earth, of a dull yellow colour. It fer-
ments

ments greatly with aqua fortis, and burns to a pretty good red. It is much used for house painting.

Hard heavy clayey yellow oker is very compact, and when dry is of a very fine bright yellow, with a smooth glossy substance. It burns to a red, but crackles in the fire. It is found in Buckinghamshire and Yorkshire, and is sometimes used by the painters.

Stony hard heavy yellow oker is in great plenty about Oxford, but it is so hard that it cannot be cut with a spade, and therefore they are forced to use pick-axes. It crackles a little in the fire, and turns to a fine red. It is also used by the painters.

Dull dusky yellow clayey oker is found in several parts of England, and is dense, compact, and heavy. It is of a dusky unpleasant colour, though it burns to a very fine pale red, and becomes almost as hard as a stone.

Light clayey oker, of a brownish yellow, is sometimes found among other strata, and in their perpendicular clefts. The surface is smooth and glossy, and the texture very fine; it burns to a dead dusky brownish red. It is found in several

veral parts of England, and being of a good body is used by the painters.

Naples yellow is of a bright beautiful colour, between that of gold and saffron; but it is very loose, spongy, brittle and porous, and ferments pretty briskly with aqua fortis. When burnt it turns to a deeper yellow, and is found in Italy, particularly about Naples. It is generally esteemed a pretty good colour.

Brittle heavy red oker is common in several parts of England, and is of great use among the painters. It crackles a little in the fire, where it becomes more hard, and of a paler colour. It is used by painters for priming the coarser sort of works.

Brittle purple oker is very common in Spain; it is of a very fine colour, and, though of a loose texture, weighs very heavy. It is of a fine deep purple before it is dug up, and when dry it turns red. It is a strong alkaly, and therefore ferments greatly with aqua fortis; in the fire it turns to a paler red.

India red is a fine purple earth, of a firm, compact, and hard texture, it being heavy, and almost as hard as a stone. Before it is dug up it is of a blood colour,

lour, but when dry of a fine glowing red, and is full of bright glittering particles of a whitish colour. In the fire it burns to a greater hardness without much changing of the colour. It is found in the island of Ormus, in the gulph of Persia, from whence it is by some called the Persian earth.

Bright red brittle oker is found at Bengal, and though used in France is not much known in England. It is of a fine, bright, florid red, and pretty heavy, though it crumbles between the fingers, and stains the hands. It ferments with aqua fortis, but undergoes little alteration in the fire.

Pale red oker is light, brittle, and of an alkalious nature, for it ferments very briskly with aqua fortis. It somewhat resembles the Venetian oker, only it is brighter, and of a little paler colour. It is found in Florida, and perhaps in other parts of America, though it is not much known in England.

Pale red clay oker is found in North America, and, though pretty heavy, is of a loose brittle texture. It is nearly of a flesh colour, and burns to a good red in the fire.

Earth of *Sinope* is so called from a town of that name in Natolia, and is a sort of bole, sometimes of a deeper, and sometimes of a paler colour. It has been sometimes used in medicine, on account of its being of a drying nature, and particularly in fluxes of the belly.

Red chalk is of a very dense compact substance, and is of a dull red colour. Some use it in the manner of crayons, or rather like black lead pencils. It is very well known to painters, and therefore requires no farther description. It is found in several parts of Europe, and particularly in Flanders.

Red stony oker is the hardest and driest of any of this kind, and is found in regular strata in the earth, but is so hard that it cannot be got up without pickaxes. It is of a fine purplish red, and is very heavy, being mixed with fragments of lead ore, of a bright blueish colour; as also a small quantity of pure native cinnabar. It burns to a fine red, and becomes more hard in the fire. The painters call it Indian stone red, it being brought from China; but it is very scarce.

Brown umber is a kind of oker, and much used by painters. It is found loose

in small lumps among gravel, and sometimes in the perpendicular clefts of other strata. It is very light, though of a close compact texture, and burns to a deep brown in the fire. It is generally brought from abroad, there being very little of it in England, though it is thought to be in Mendip Hills, in Somersetshire.

Cologne earth, called also Cullen's earth, is well known among the painters, and is of a dusky brown, with a close, compact, fine texture, but extremely light. It is not at all gritty, and has the taste of oak bark. Being thrown into the water, it swims on the surface till it is quite wet, and soon breaks into a fine powder. It is easily set on fire, and never goes out till it is reduced to pale yellow ashes; from whence it appears to be of a vegetable nature, owing its origin to wood long buried in the earth. It is brought from the city of Cologne.

The Armenian stone is very opaque, and mixed with green, blue, and black spots, somewhat in the manner of lapis lazuli. It is of an even regular texture, and the general colour is a beautiful blue. Some think it differs in nothing from lapis lazuli but in hardness. It was

was formerly used in medicine as a purge and emetic, and the dose was from six grains to a scruple; but it is now out of use, except among the painters, for when it is prepared, it yields a fine blue colour, with a greenish cast.

Green oker, or tincall, is of a dense, compact substance, though of a coarse irregular texture, the surface being rough and uneven, and the colour of a pale green. It is common in many parts of Germany in and near the copper mines, and it partakes very evidently of copper. By burning it turns to a hard dusky brown oker, and therefore is only used in its natural state, it being reckoned a very good article in painting.

Heavy brittle black oker is found in masses of different sizes, in the perpendicular clefts of stone. It is of a fine deep black, and of a compact, even, close texture, though it breaks very readily into small pieces between the fingers, and slightly stains the hands.

Black chalk is found in broad flat pieces, from two to ten feet long in the earth, and from four to twenty inches in breadth. It is moist and flaky when taken out of the ground, but soon becomes pretty hard, and very light. It will
cleave

cleave very easily one way, and seems to be the offspring of wood buried in the earth; for it will burn, but not so long as Cogn earth. It is much used in painting, and is found in Spain, Italy, and Germany.

OF BOLES.

BOLES are a genus of earths, moderately coherent, ponderous, soft, and not stiff, and viscid; composed of fine particles, smooth to the touch, easily breaking between the fingers, readily diffusible in water, and freely and easily subsiding from it. Three kinds of boles are ranked among medicinal earths, Armenian, red, and white. That met with in the shops, under the name of Armenian, is not the produce of Armenia, or any of the oriental countries; but, like the others, of different parts of Europe, as Bohemia, Silesia, Saxony, Hungary, Transylvania, France, Norway, &c. The French employ chiefly the bole of Blois. We need not be solicitous about the particular place where any of the holes have been dug, provided they are pure and of good quality.

Bole

Bole *Armenic*, is of a pale colour, between red and yellow, smooth and slippery to the touch, somewhat glossy, pure from sand, or any perceptible gritty matter. It readily crumbles betwixt the fingers, and adheres to the tongue. Softened with water, it forms a smooth paste; diluted with a larger quantity of water, it remains for a considerable time suspended. Bole armenic, like most of the other coloured earths, contains a portion of ferrugineous matter, to which its colour is owing, and which may be separated by the magnet, after the bole has been calcined with oil, or other inflammable matters. It is likewise impregnated with vitriolic acid; and hence when mixed with nitre or sea-salt, it extricates the acids of those salts in the fire.

This earth is employed medicinally as a styptic, both internally and externally: a virtue which seems to proceed from its ferrugineous impregnation: to the antipestilential and alexipharmic qualities, for which it has long been celebrated, it has no pretence; nor have the absorbent ones, which some ascribe to it, any just foundation. It is prepared or purified by washing it over with water; the pure bole remaining suspended a considerable time,

time, so as to be poured off with the liquor, whilst the sandy or other grosser matter remains behind : after the bole has settled from the water, it is moderately dried : formed into rolls or cakes, and afterwards further exsiccated for use. Some have condemned this method, as depriving the bole of a certain central salt : but this earth contains nothing that water is capable of extracting. Bole armenic, treated with water, remained undiminished in weight, and neither the bole or the water received any sensible alteration.

Red bole, the common sort of this earth, is coarser than the Armenian, and participates more largely of iron ; hence it is never given internally, unless to cattle.

White bole is brought to us ready washed, and formed into large rolls or cylindric globes, not of a chalky whiteness, but rather of an ash-colour. Formerly it came only from Tuscany, or the island Elva : at present it is supplied chiefly from Norway, the island Bornholm, or places nearer home. It differs from the two preceding in containing no manifest irony matter, and consequently in wanting their astringency.

It

It has been recommended as an absorbent; but experiments made upon it with acids, shew that it little deserves that character, any more than the other boles. Some have a method of recovering the lustre of pearls, especially the Scotch ones, by warming them a little over the fire, and rubbing them with powdered white bole*.

OF TRIPOLY.

TRIPOLY is an earthy substance, much used by the lapidaries to polish stones, and by the braziers to clean metalline vessels. It easily breaks between the fingers, and has a taste like that of pumice stone, but with no sandy grittiness. It grows hard in the fire without changing colour. It is of various sorts; as the yellow tripoly; the reddish white tripoly; the greenish red tripoly; the pale brown tripoly; the sparkling brown tripoly; and the red sparkling tripoly.

OF TALC.

TALC is a large class of fossil bodies, composed of broad, flat, and smooth

* Newman's chemistry.

plates, laid regularly upon one another ; easily fossible, according to the site of those plates, but not in the least so in any other direction : flexible and elastic ; bright, shining, and transparent ; not giving fire with steel, nor fermenting with acid menstrea, and sustaining the force of a violent fire without calcining. Where talc is found in any considerable quantity, it is employed in compositions for earthen vessels ; and by some for tests and cupels. From its smoothness, unduosity, and brightness, it has been greatly celebrated as a cosmetic ; and the chemists have submitted it to a variety of operations, for procuring from it oils, salts, tinctures, &c. for that intention. But all their labours have been in vain ; and all their preparations sold under the name of talc, have either contained nothing of that mineral, or only a fine powder of it.

Venetian talc has been principally celebrated as a cosmetic. There are great varieties of this class : the shining gold coloured talc is found in several parts of England, particularly in Europe. The shining talc, with the appearance of silver, is found in several parts of Italy and England. The greenish shining talc is
D found

found on the shores of Italy, and on Mendip hills. The greyish green talc is found on the shores of Yorkshire and Lincolnshire. The grey shining talc is very common on the English shore. The bright green shining talc, with broad spangles, is found in the beds of rivers in Italy. The East Indians have a heavy, shining orange coloured talc. English talc, so called in the shops, is of a coarse, harsh, rough kind, with an unequal surface, and of a loose brittle texture. It is found in clay and marl pits, as well as among the strata of gravel, and the fissures of stone, and will burn into very good plaister; on which account it is usually called the plaister stone. When burned it is used for cleaning silver lace.

OF AMIANTHUS.

THIS is vulgarly called earth-flax, and is a fibrous, flexible, and mineral substance, composed of short and abrupt filaments. It is a stony concrete, of the talky kind, though differing from talc in its external appearance. It is neither so bright, so smooth, nor so untu-ous; and is not composed of leaves or plates,

plates, but of long filaments like flax : it has been spun into cloth, and formed into paper, incombustible and indestructible in the fire. There are some sorts of amianthus whose filaments are rigid and brittle, and others more flexible : the first cannot be spun, or formed into cloth ; the latter may, but not without difficulty. This manufacture appears to have been known among the ancients, who, according to Pliny, wrapt the bodies of the dead in Amianthine clothes, to preserve their ashes separate from those of the funeral pile : a use to which they are still said to be applied among the princes of Tartary.

OF GYPSUM, OR PLASTER STONE.

THIS is a genus of fossils, naturally and essentially simple, not inflammable nor soluble in water, and composed of small flat particles ; which form bright, glossy, and in some degree transparent masses ; not flexible or elastic ; not giving fire with steel, nor fermenting with, nor being soluble in acid menstrua, and very easily calcining in the fire. Some of these gypsums are harder, and others

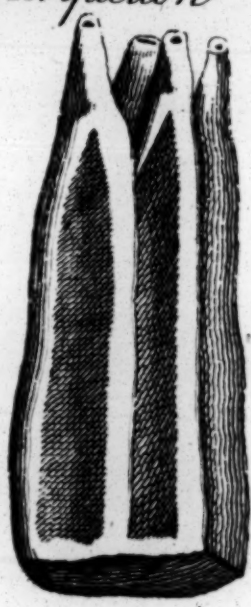
softer: they are of several colours, as white, grey, red, green, &c. sometimes distinct, and very variously blended together. They are much used in plaster for stuccoing rooms, and casting busts and statues. The hard white gypsum, or plaster of Paris stone, is chiefly found in France; but there is a soft white gypsum found in many parts of Derbyshire.

OF THE SELENITES.

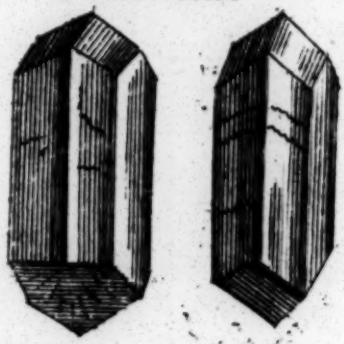
THESE are stones consisting of slender fibres, ranged in fine even flakes of different forms, according to their kinds. Like talc, they will cleave, not only horizontally but perpendicularly; and tho' they will bend a little, they have no elasticity. They will not ferment with aqua fortis, nor readily calcine in the fire. The thin, fine, transparent selenite, with transverse streaks, is a common sort, and is found from one tenth of an inch to five or six inches long. It is composed of fine thin plates, irregularly disposed through the whole breadth of the mass. These plates, or flakes, cleave almost as readily as talc, and easily separate from each other in an horizontal direction. This selenite is pretty soft, and as void

of

Petrifaction



Selemites





of colour as crystal : in the fire it turns to a pure opaque white. It is found in the strata of clay in many parts of England. There are other species of the selenite : as the thick dull selenite ; the brown transparent selenite ; the long scaly selenite ; the colourless transparent selenite, &c.

OF CRYSTAL.

CRYSTAL is a soft transparent gem, having somewhat the appearance of frozen water. It is the softest of all gems, and, when coloured, goes by another name ; though it ought not to be substituted for the more precious sorts of stones. It is called a bastard topaz, when it imitates a beryl.

The bright crystal, with a long intermediate column, and without any colour, appears to be the most perfect of the kind, and is generally free from blemish. It is pointed at each end, and consists of sixteen planes or sides. It is found from the size of a barley-corn to the length of three inches, but an inch in length is the common size. Where one is found, there are generally others at no great distance. It is moderately

heavy, will strike fire with steel, and, when calcined, is of an opaque white. It is common in the mountains of Germany, but is seldom found in England.

The blackish bright crystal is remarkably bright, transparent, without clouds, and has what is called a black water. It is found in Italy, but is very uncommon.

Dull whitish crystal, with irregular pyramids, will strike fire with steel, and calcines easily into a pure white. It is common in Germany, and is sometimes found in Yorkshire and Cornwall.

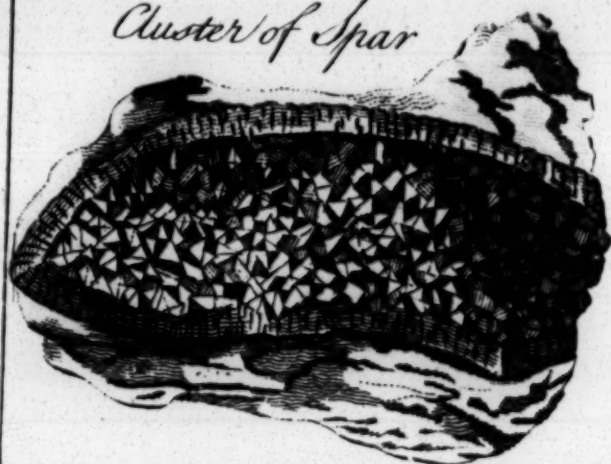
Yellow bright crystal, with regular pyramids, is very hard, strikes fire with steel, and when calcined is entirely white. It is frequently found in Silesia and Bohemia, and sometimes in Yorkshire.

Brown crystal, consisting of two long pyramids without a column, is perfectly pure and regularly formed. It is very hard and of a fine water. It is found in Scotland on the sides of hills, and on the banks of rivers.

Crystal, having two pyramids only, with eight sides each, is of a very uncommon kind; it is fine and clear, tho' often spotted with black. It is very hard,



Cluster of Spar



Conchites



hard, and calcines to a pure white. It is found in Virginia, on the sides of hills.

Crystal, without colour, consisting of two longish pyramids, with eight sides each, is very hard, very transparent, and of a very fine water. It is found only in some parts of Saxony, and is extremely scarce.

OF SPARS.

SPAR, that has a narrow oblong pyramid, resembles crystal with eight sides, is of a pure fine texture, and the most perfect of all the class; having a column with single angles with a pyramid consisting of the same number. The twelfth part of an inch is the common length, though some have been seen of three quarters of an inch. The larger specimens are generally found loose; but they are usually among the coarser strata of stones. This spar will dissolve in aqua fortis, and will calcine easily in a moderate fire. It is found in the mountains of Germany, and in North Wales.

There are great variety of spars: as the spar, with very short pyramids and a long column; the spar with long pyramids and a long column, found in Germany,

many, Derbyshire, and Cornwall; the milk-white opaque flattery spar, &c.

The hard transparent spar, commonly called Iceland crystal, of the shape of a parallelopiped, is extremely pure, clear, and fine; it is found of various sizes, from a quarter of an inch to three inches in diameter; but its usual size is two inches and an half: it is almost as transparent as fine crystal, but is very soft. It is found in Iceland, Germany, and France, and consists of plates laid one upon another, cleaving in the manner of talc. It has this singular property, that all objects appear double through it, owing to the double refraction of the rays of light.

OF SALT.

SALT is a series or subdivision of fossils, naturally and essentially simple, not inflammable, and soluble in water. Shaw defines salt to be a substance that readily dissolves in water, tastes sharp or pungent upon the tongue, and has a great disposition to unite with earth, so as to appear in a solid form, as in common salt, alum, &c. Salts then are fossile bodies, friable, pellucid, not inflammable,

ble, but fusible by fire, and congealing again in the cold; soluble in water, so as to disappear in it, naturally concret- ing into regularly figured crystals, and impressing a sensation of acrimony on the tongue. These are the characters and qualities common to all salts, and to no other bodies; and these they always manifest when pure and freed from heterogeneous substances: but in the state in which they are naturally found in the earth, though they have that in their taste alone which may sufficiently distinguish them, yet they do not exhibit all their genuine characters; some of them being found solid and pure, either within the earth or on its surface, but commonly without their proper form; others embodied in earths and stones, as the particles of metals in their ores; and others in a fluid state suspended in waters. Of the fossils of this class, nature therefore affords us three distinct orders, and under those they are distinguishable into five genera. The salts of the first order are those found native and pure, either in the earth or without its surface, and exhibiting all other natural characters, though often without their proper form. Of the second, are those found not native,

tive, but in form of ores, never pure, but distinguishable by their taste, and immersed in and blended with the constituent matter of earths and stones in extremely small particles. And the third are those naturally found suspended in waters, and in a fluid form, but ready to assume their proper figures on the evaporation of a part of that water. Of the first of these orders, are the common alimentary salt or muria, and the natrium or nitre of the ancients, of the second are alum and nitre, and the third are borax and halcruptium, an alkaline salt hid in the chalybeate waters.

Alimentary salt, or muria, is found under a great variety of forms in its different states: but is immediately distinguished by applying to the tongue, and always assumes a cubic, pyramidal or parallelopiped figure after solution, and regular crystallization. It is sustained in vast quantities in a liquid form among sea-water, and that of salt springs; but is also found solid in the bowels of the earth in vast masses, which are either of a fine pellucid structure, and called salgern; or various, debased and striated, resembling the fibrose talcs, and the sal ammoniac of the ancients. But in which

ever

ever of these forms this salt is found, it affords the same crystals on evaporation; these, according to the degree of heat and in the evaporation, are either pyramidal, cubic, or parallelopiped. All these salts are soluble in water; but they require different quantities of it to dissolve them, and this makes one of their criterions. This salt requires thrice and one-seventh part of its own quantity of water, to make a perfect solution. The sea-water, in different parts of the world is very differently sated with it, some parts containing twice as much as others. But that of the salt-springs is always much more sated with it, than the strongest of the sea-water; in some places it is found loaded with nearly as much as it could be made to contain, some springs yielding a brine that affords near a quarter of a pound of salt, from the pound weight of this liquor, and many of them being so strongly impregnated, that the workmen are obliged to let them down or lower them, by mixing them with a large quantity of sea or common water, before they are fit to be boiled for the salt: the common run of sea-water does not hold so much as one-fourth part of this quantity, some not one-eighth of it. The salt

salt produced from the sea-water of all the parts of the world, and from the brine of all the springs in the world, is absolutely the same, but differs in strength and some other qualities, according to the operation by which it is made. In general, the quicker the liquor is evaporated, the weaker is the salt; the more time is employed in the process, the stronger. This is not wonderful, when we consider, that, over a gentle heat, water alone, or almost alone, evaporates from the liquor, but over a more violent fire, a part of the strength or acid of the salt is raised with it. It is upon this principle, and owing to this cause, that we find the salt of our salt springs, which is usually sold us under the name of basket-salt, the weakest of all. It is not that there is any difference in the waters from which these several kinds of salt are produced, that they appear to us in different degrees of strength, but that the people who work the brine-pits, make the salt with less expence of the workman's time; that the sea salt is formed over somewhat slower fires; and that the bay salt is made only by the sun's heat, where the process is very long, and the heat very moderate, and the salt is found strong in proportion.

proportion. This is so indisputable a truth, that once every week a very strong salt, little inferior to bay-salt in that quality, is made at the brine-pit works, where the common run of salt is the weakest in the world. The liquor is the same in this case, but the workmen who do not work on sundays, leave a pan full to evaporate slowly over the fire, which they prepare on the saturday night, and the moderate heat and length of time under which this weekly parcel of salt is made, render it very different from the common salt of the works, both in form and qualities ; it is found to be made up of large and hard grains, instead of small and soft ones of the common kind, and is vastly superior to it in strength. This circumstance, over-looked by the workmen, and even by their masters too, for many years, gave a hint to Mr. Lownds, and afterwards to the very ingenious Dr. Browning, author of an excellent treatise on this subject, to propose to the government a method of making a salt fit for all the purposes for which we buy it of our neighbours, only by a new, that is, a slower way of working our own brines. The latter of these gentlemen has proved incontestably ; that we may,
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if we will encourage proper manufactures, have common salt of every kind made at home, equal in strength, and equally fit for all purposes, with the salt of any part of the world.

After these accounts of the muria or common salt under its different forms, and as expressed by different names, it remains to treat of its qualities and virtues in general. It resolves spontaneously in the air, but this in different times, according to the dampness or dryness of that element, and according to its own laxer or firmer structure. The coarser salts dissolve sooner than the finer, and there are even some pieces of *sal gemmæ* so firm, that they are scarce to be at all affected, even on their surface, by the moistest common air.

Common salt, added to *aqua fortis*, enables it to dissolve gold, making it into what is called *aqua regia*; by distillation it yields a strong and acid spirit; it is the most of all substances, endued with keeping animal bodies from putrefaction, and it also preserves vegetables in the same manner in long digestions. In medicine, it is a common ingredient in clysters, and serves to soften and bring away indurated fœces. Suppositories are

also

also made of a mixture of it with honey, and are put up the fundament, to promote a tendency to desuction. Aloes and colocynth are sometimes added on these occasions, when there is required more power in the medicine. In apoplectic cases, it is generally an ingredient among the stimulating things administered in clysters; only it is necessary to have this caution, that if there appear reason to suspect an inflammation of the intestines, or but a tendency to it, every thing of this kind is to be avoided.

Common salt that has not been exposed to fire, makes no change in the colour of syrup of violets; it does not make any effervescence with oil of tartar, nor does it make lime-water turbid; but added to oil of sal ammoniac, it manifests some signs of latent acidity, by rendering it cloudy; on the contrary, also, it manifests something of an alkaline nature, by rendering a solution of mercury whitish, and it raises an effervescence with oil of vitriol, attended with heat.

On solution in water, common salt manifests also two very different principles after evaporation. When reduced to a proper consistence, that is, when

the quantity of water is not more than as three to one to that of the salt, a part of it concretes into grains of salt of the ordinary kind; but there remains yet in the liquor, after all that can be separated this way has been procured, a strong taste of a saline nature; the salt that gives it this, will never be brought to crystallize, but must be separated by evaporating all the liquor away; it is then found to be of an alkaline nature, assuming no regular form in its crystals, and easily imbibing the humidity of the air, and running into a liquor with it.

The basis of sea-salt, therefore, is a mineral alkali, which is so intimately blended with its peculiar acid, that the latter has scarce any power of exerting itself.

The acid, drawn by distillation from sea-salt, turns the syrup of violets red, and ferments vehemently, though without heat, with oil of tartar; but it does not heat on being poured into lime-water. This spirit is the only one that can be properly called a solvent for gold and for tin, but silver and lead resist it. The acids of nitre and vitriol, also, obtain the same qualities on being mixed with it, and become aquæ regales.

this acid be perfectly saturated with salt of tartar, crystals of the form and qualities of those of common salt may be obtained from the mixture; these crystals are called regenerated sea-salt, and serve to prove what we observed above, that an alkali is the basis of sea-salt, and that more alkalies than one may serve to that purpose with the peculiar acid, which is the essential part of this salt.

Physicians are of opinion, that sea-salt has the same effects in the human body that it has out of it, in checking fermentation, and preventing putrefaction: they therefore esteem it of good use mixed with the generality of our foods in the stomach: they are of opinion also, that it carries its effect into the blood, and has the qualities of a moderate dryer, detergent and attenuant, added to those of a stimulant, which common reason declares it to be. Hence may be deduced all the virtues attributed to salt, as an aperient, stomachic, or warming medicine, and a provocative to venery; but in what degree it possesses all these qualities, we are, by its universal use in foods, prevented from being able to determine. Van Helmont recommends it as a good preservative against the stone

and gravel: he has been severely censured for this by others, who are of opinion, that all salted foods, such as salt beef, and the like, are very bad in those cases: but both parties may be in the right; for there is a great deal of difference between common salt eaten with the fresh juices of our food, and the brine and pickle into which it runs in the time of its being left upon the meat preserved by it. Salt is very properly put into the mouths of people in apoplectic fits, as it not only irritates but attenuates the juices there, and promotes a discharge of them; and in a palsy which affects the tongue, a sage-leaf, bruised and covered with salt, has been a famous remedy among the good women, and not without reason.

Mixed with bran, and heated in a canvas-bag, it is recommended to be applied externally to the head in head-achs, arising from a moist cause, and in defluxions; and we find the old physicians very strenuously recommending a cataplasm made of the same ingredients for pains.

Methods of making alimentary SALT are these: 1. by the evaporation of the sun's rays: this is the most easy and simple

Simple method of all, when the water of ponds and lakes, whether natural or artificial, impregnated with salt, being wholly exhaled by the force of the sun and air, the salt is concreted into a hard crust at the bottom of the lake, and is what commonly goes by the name of bay-salt; the crystals of which differ in size, according to the different degrees of heat, and the time it lies in the pits. All bay-salt has some mud, slime, or the like, in the making, and some kinds are mixed with the bittern-salt, or what is called Epsom-salt; they are all more white while dry, and more pellucid when moist, and they differ in colour, according to the earth which makes the bottoms of the pits. Thus some of the French bay-salt is grey, some reddish, and some white, according as a blue clay has lined the pits, or a red, or a white one. Some kinds have an agreeable smell in large heaps; such are the Portugal, and the Hampshire bay-salts; and this seems owing to the sea-water they were made from, having a bituminous matter in it. It differs also greatly in taste, according to the various foreign mixtures it contains; and it will often alter the taste, and other qualities,
by

by long keeping: for, in general, it is much fitter for use, after it has been kept some time in a dry place, than when it is first made.

2. By boiling, or coction, the most convenient works for which process are constructed in the following manner: the saltern or boiling-house is erected near the sea-shore, and is furnished with a furnace and one or two large pans, which are commonly made of iron plates, joined together with nails, and the joints filled with a strong cement; and the bottoms of the pans are prevented from bending down, by being supported by strong iron bars.

The salt pan being filled with sea-water, a strong fire of pit-coal is lighted in the furnace, and then, for a pan which contains about fourteen hundred gallons, the salt-boiler takes the whites of three eggs, and incorporates them all with two or three gallons of sea-water, which he pours into the salt-pan, while the water contained therein is only lukewarm, and mixes this with the rest, by stirring it about with a rake. In many places they use instead of eggs the blood of sheep or oxen to clarify the sea-water, and in Scotland they do not give them
selve

elves the trouble of clarifying it at all. As the water heats, there arises a black frothy scum upon it, which is to be taken off with wooden skimmers. After this, the water appears perfectly clear, and, by boiling it briskly about four hours, a pan loaded in the common way, that is about fifteen inches deep, will begin to form crystals upon its surface. The pan is then filled up a second time with fresh sea-water; and, about the time when it is half filled, the scratch pans are taken out and emptied of a white powder, seeming a kind of calcareous earth, which separates itself from the sea-water, during its boiling, before the salt begins to shoot. When these have been emptied, they are again put in their places, where they are afterwards filled again. This powder, being violently agitated by the boiling liquor, does not subside till it comes to the corners of the pan, where the motion of the mass is smaller, and it there falls in these pans placed on purpose to receive it.

The second filling of the pan is boiled down after clarifying in the same manner as the first, and so a third and a fourth; but in the evaporation of the fourth, when the crystals begin to form them-

themselves they slacken the fire, and only keep the liquor simmering. In this heat they keep it all the while that the salt is granulating, which is nine or ten hours. The granules or crystals all fall to the bottom of the pan; and when the water is almost all evaporated, and the salt nearly dry at the bottom, they rake it altogether into a long heap on one side of the pan, where it lies a while to drain from the brine, and then is put into barrows, and carried to the store-house, and delivered into the custody of his majesty's officers. In this manner the whole process is usually performed in twenty-four hours, the salt being commonly drawn out every morning. This is the method in most of our salt works, but in some they fill the pan seven times before they boil up the salt, and so take it out but once in two days, or five times in a fortnight. In the common way of four boilings, a pan of the usual size, containing one thousand three hundred gallons, they draw from fifteen to twenty bushels of salt every day, each bushel weighing fifty-six pounds.

When the salt is carried into the store-house, it is put into drabs, which are partitions, like stalls for horses, lined at
three

three sides, and the bottom with boards, and having a sliding-board on the fore-side to draw up on occasion. The bottoms are made shelving, being highest at the back, and gradually inclining forwards; by this means the brine remaining among the salt, easily separates and runs from it, and the salt in three or four days becomes sufficiently dry; in some places they use cribs and barrows, which are long and conic wicker-baskets for this purpose, and in some places wooden troughs with holes in the bottom. The saline liquor which remains after the making of salt is what is called bittern.

Much in the same manner is the salt obtained from the brine of salt springs, pits, &c. White salt is prepared from sea-water, or any other kind of salt-water, first heightened into a strong brine by the heat of the sun, and the operations of the air. It may also be prepared from a strong brine, or lixivium, drawn from earths, stones, or sands, strongly impregnated with common salt. Refined rock-salt is that obtained by dissolving fossile or rock-salt in salt or fresh water, and afterwards boiling the solution. And, lastly, salt upon salt is made from

from bay-salt dissolved in sea-water, or other water, and boiled to a white salt.

OF NITRE.

NITRE, or Saltpetre, is a neutral salt, formed by the coalition of the common vegetable fixed alkaline salt with a peculiar acid: of a sharp, penetrating, cooling taste: soluble in eight times its weight of very cold water; in less than thrice its weight of water temperately warm, and in one third its weight of boiling water.

The origin of nitre, or rather of the acid which makes the characteristic part of nitre, is unknown. Thus much only is known with certainty, that common waters, both atmospherical and subterraneous, often contain a little of this acid in combination with earthy or other bodies, so as to yield, by crystallization, on supplying the vegetable fixed alkali, a perfect nitre: and that when animal or vegetable substances, mixed with porous absorbent earths, have lain exposed to the air till they are thoroughly rotted, they are found in like manner to contain a small portion of nitrous acid, so as to give out a little nitre to water, on being supplied

supplied with the proper alkaline basis. On this foundation, some nitre is prepared in different parts of Europe; but the greatest quantities are the produce of the East Indies: the means by which it is there so plentifully obtained, or whether it is a natural production, have not yet, so far as we can learn, been revealed. Nitre, as brought into the shops, has generally a greater or less admixture of sea-salt, from which it is purified, by dissolving it in boiling water, and, after duly evaporating the filtered solution, setting it in a cold place to crystallize. This salt is one of the principal medicines of the antiphlogistic class; of general use in disorders accompanied with inflammatory symptoms, whether chronic or acute, and as a correction of the inflammation or irritation produced by stimulating drugs. Hoffman thinks it has an advantage above the refrigerants of the acid kind, in not being liable to coagulate the animal juices; solutions of it mingling with or dissolving recent thick blood, and in some degree preserving it from coagulation, as well as corruption; at the same time changing its colour, when dark or blackish, to a crimson; an effect which it produces al-

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so, in a less degree, upon the fleshy parts of the dead animals. It retards also the coagulation of milk, but seems, from Stahl's account, to increase the consistence of thin serous humours; for he observes, that when used in gargarisms for the inflammations of the fauces in acute fevers, it thickens the salival fluid into a mucus, which keeps the parts moist for a considerable time; whereas, when nitre is not added, a dryness of the mouth presently ensues. This medicine generally promotes urine, and often gives relief in stranguaries and heat of urine, whether simple, or proceeding from a venereal taint. It sometimes loosens the belly, particularly in hot dispositions: in cold phlegmatic temperaments it rarely has this effect, though given in very large doses, even to an ounce: the diarrhæas of acute diseases, and fluxes in other circumstances, for an acrimony of the bile or inflammation of the intestines, have been frequently restrained by it. In high fevers it often promotes a diaphoresis or sweat: in malignant fevers, where the pulse is low, and the strength greatly depressed, it impedes that salutary excretion and the eruption of the exanthemata, in consequence of its general power

of diminishing any heat. It seems to be prejudicial in disorders of the lungs, tho' some have ventured to prescribe it in he- motypses.

The usual dose of nitre, among us, is from two or three grains to a scruple; though in many cases it may be given with great safety, and to better advantage, in larger quantities.

Nitre may be commodiously taken in the form of troches; one part of the purified salt is commonly ground with three parts of fine sugar, and the mixture made up with mucilage of gum tragacanth. In this and all other solid forms it is accompanied, however, with one inconvenience, being liable, especially when the dose is considerable, to occasion a pain or uneasiness at the stomach, which can be prevented only by plentiful dilution. A liquid form is therefore, in general, the most eligible, and may be easily rendered grateful by a proper addition of sugar: commonly half an ounce of nitre, and two ounces of fine sugar, with a scruple of cochineal, as a colouring material, are boiled in two pints and a half of water, till half a pint is wasted, and after standing to settle, the clear purplish red liquor poured

off, for use. The boiling serves only to hasten the solution, and need not be continued longer than till the salts are dissolved, and a sufficient colour extracted from the cochineal.

OF VITRIOL.

VITRIOL, which is either native or factitious, is distinguished into white, blue, and green. White vitriol is brought in large lumps from Germany; it has the appearance of loaf sugar, and has a sweetish astringent taste. It is found in mines in Gloslaer, in Saxony, where it springs from the sides, under the appearance of a woolly substance, which being dissolved in water, must be boiled to a due thickness; and it will at length turn into a white mass, like sugar. Sometimes there are found in the same mine pieces of vitriol, which are already crystallized, and appear transparent.

Blue vitriol is dry to the touch, and is formed into blue crystals, like sapphires. It is prepared in many places, particularly in Cyprus and Hungary; whence it is usually called Hungarian and Cyprian vitriol. It obtains its fine colour

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from copper, and has an austere taste, with great sharpness.

Green vitriol has various names, according to the different places from whence it is taken. It abounds with iron, and is either in large crystals of a rhomboidal form, or in bits composed of crystalline grains united together, which feel a little oily to the touch; it has a sharp styptic taste.

White vitriol is very good for making an eye-water, which is perhaps the best hitherto known, for abating inflammations of the eyes, and to repel fluxions thereon. It is made by dissolving a scruple of vitriol in hot rose water, and then passing it through a linen cloth. Blue vitriol, when calcined, is very proper for stopping hæmorrhages, by cauterizing the vessels, and condensing the blood therein. Spirit of vitriol, like other acid spirits, restrains the heat of the humours, stops hæmorrhages, and operates as a diuretic.

OF ALUM.

ALUM is a semi-transparent, austere styptic salt, composed of the vitriolic acid, and a certain earth, found in all

the argillaceous fossils hitherto examined. The greatest quantities of this salt are artificially produced from different kinds of minerals, whose nature and composition are little known.

The reddish Roman alum is prepared from a reddish stone found at the bottom of the hill Tolfa, near Civita Vecchia, in the ecclesiastical state. In Sweden and some part of Bohemia, alum is made from Pyrita and other ores, in England, at Alsattel, and sundry other places, from bituminous minerals of the pit-coal kind, at Soltafarre near Naples from a whitish earth; in Misnia, from a blackish one; at Leauenberg near Freyenwalde, from a reddish one; and from different minerals at Seralfield, Reichenback, Leufersdorff, Supersdorff, Eliard, Schwentzel, Duben, &c. The purest and most perfect ore is the reddish stone of Tolfa; this is said to yield alum without any additional matter, though not without artificial management; the alum obtained from it is tinged with the reddish colour of the stone. In its natural state it gives no marks of alum; and, if exposed to the air, it continues a hard insipid stone. Calcined or roasted, and then laid for a time in the air, it becomes

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by degrees aluminous, and gives out its alum on being boiled in water. This alum the Italians call *alum di rocca*, alum made from a stone or rock; among us, the name *alumen rupeum*, or rock alum, is often applied to the larger crystalline masses, whatever subject they have been prepared from. The aluminous pyritæ and bitumen require no calcination, unless they greatly abound with sulphur. These minerals, at first taken out of the earth, are compact, and often bright and glittering: they have no manner of taste, and discover no mark of their holding any thing saline; the vitriolic acid being as yet blended with an inflammable matter, by which its acidity and all its saline characters are destroyed. On bare exposure to the open air, the inflammable principle is dissipated, and the acid is combined with the aluminous earth into a perfect alum, the stone at the same time falling into powder. The mineral, thus impregnated with alum, is elixated or boiled with water; the liquor boiled down, commonly with an addition of urine, or alkaline ley, or both together; the clear part poured off and set to shoot: the crystals if not sufficiently pure, dissolved again, boiled down with a little more

more alkali, and crystallized afresh. The use of urine or alkali salt is partly to clarify the liquor, and precipitate such metallic parts as it may contain, and partly to give a body to the alum, and promote the crystallization; the liquor of itself would not shoot, but either continue fluid, or if further evaporated, would yield only an unctuous mass. Alkaline salts are found to answer better than urine, and hence are now in most places alone made use of, though some still retain urine from prejudice and custom. The alkali precipitates not only in metallic matters, but a gross earth which would injure the transparency of the salt, and often also a part of the aluminous earth itself, which falls to the bottom in form of a fine white meal, called at the works alum meal; this is to be redissolved and crystalized afresh. The mineral remaining after elixation, exposed for some years to the air, becomes impregnated with alum again; in some places this process is repeated a third and a fourth time.

The alum flats near York, in England, are considerably sulphureous; by lying long in the air, they become aluminous of themselves; but to promote

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this effect they are usually calcined. The boilers are large leaden pans, nine feet long, five feet broad, and two and a half in depth; the liquor is clarified and disposed to crystallize by the addition of soda, there called kelp, and of urine. The crystallization of alum is usually performed in large strong wooden casks, whose staves and hoops are all marked with numbers, that they may be readily put together; in some places iron vessels are used. The casks being filled with the alum liquor evaporated to a due consistence, and set in a cold place, the alum gradually shoots into large crystals about the sides; the liquor in the middle is then let off by a cock in the bottom, the head of the cask knocked out, and the vessel turned upside down, for the more effectual draining off of the remaining liquid. The crystals are then dried in a warm stove, and packed up in casks; and the mother-ley, or uncrystallized liquor, mixed with fresh aluminous leys. Alum requires about ten times its weight of water to dissolve in. The solution, if the alum was pure, makes no change in the colour of syrup of violets; but the common sorts change the syrup green, by virtue of the alkaline salt employed
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in their preparation. Fixed alkalies, volatile alkalies, and borax, added to solutions of alum, precipitate the earth. Its taste is nauseously sweetish and astringent. In crystallization, it shoots into large annular masses, consisting generally of eleven planes, five of which are hexangular and six quadrangular. *Burnt* alum is nothing more than alum exposed to the action of the fire; by which means it liquifies, and boils up like green vitriol; and when its phlegm is evaporated, forms a white spongy brittle mass,

OF SULPHUR.

SULPHUR is a mineral substance, fusible and inflammable by fire, and not dissoluble or miscible in water. The name of sulphur has been applied by some to the inflammable principle of bodies; by others, to all inflammable mixts, or substances participating of this principle; and the alchemists speak also of a sulphur that does not burn. Vegetables, oils and resins, animated fats, mineral bitumens. This confusion has given rise to numerous errors and absurdities: how widely different is the true sulphur, in all its properties, from bitumens, or oils,

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or any other kind of inflammable body ! if every thing that burns may be called sulphur, we might with equal propriety call every thing that is liquid by the name of water, or of spirit of wine, or vinegar, or oil, or any other particular liquor. Experiment has fully evinced, that sulphur is no other than the concentrated vitriolic acid combined with a small proportion of the phlogistic or inflammable principle; and to this combination alone, which is always one and the same, excepting for adventitious admixtures; the more judicious chemists have wholly confined the name.

Sulphur is a solid brittle concrete, of a yellow colour, inclining a little to a greenish, in some degree glossy. Held in the warm hand, it crackles or bursts : and leaves on the hand a particular smell. It is nearly twice as heavy as an equal bulk of water. It melts in a small degree of heat into a red pellucid fluid, and on cooling concretes again into its original appearance. Some have endeavoured to purify sulphur from the drossy matters which are often mixed with it, by melting and pouring it into spirit of wine; others have melted it with wax, and poured the fluid mixture into water when

when the sulphur subsides, and the wax arises to the surface, carrying up with it a part of the impurities. With regard to spirit of wine, it can have no effect in separating foreign matters from the sulphur, though it seems in some measure to heighten the yellow colour. Wax on the other hand renders it greener, and if the fusion is several times repeated, changes it quite blackish.

Sulphur kept in fusion, gradually exhales : if the air is excluded, it sublimes into the upper part of the vessel, without undergoing any other alteration, than being reduced into the form of powder or flowers. This properly affords a method of purifying it effectually from earthy, stony, or other fixed matters ; and at the same time of reducing it into a finer powder than can easily be obtained by tritulation. Where only a small quantity of flowers of sulphur is wanted, the sublimation may be performed in a jar, with abedels closely luted upon it and a blind-head at top. In England they are prepared by particular persons in the way of trade : the subliming vessels in an iron pot, so large as to hold two or three hundred weight or more of sulphur, about a fourth of its capacity
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remaining empty: the recipient is an arched room built above the pot, and communicating with it at one side by an aperture of six or eight or more inches in diameter. The room is lined with glazed tiles; and furnished with a door, by which a man may creep in, when the operation is finished, to sweep out the flowers. In the middle of the door is a small hole, which is opened occasionally during the sublimation, for examining whether the flowers continue or have ceased to arise.

In open vessels, sulphur readily takes fire from the contact of ignited bodies; and if kept in fusion, burns entirely away, with a blue flame, and a diffusive suffocating fume. This fume is no other than the vitriolic acid volatized by the flame: a considerable quantity of it may be detained, and condensed into a liquid form, by placing over the burning sulphur capacious glass vessels, replete with aqueous vapours: the larger the receivers, and the less communication the flame has with the external air, the more of the fumes will be preserved.

The common apparatus for this purpose consists of a little earthen dish, for burning the sulphur in; a glass bell, sus-

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pended over the flame; and a broad glass or earthen vessel, which supports the dish with the sulphur, and receives the acid liquor as it drops from the sides of the bell. Many variations have been made in this apparatus, with a view to detain the fumes more effectually. Instead of the bell, from which the acid has received the name of spiritus sulphuris per campanam, some have employed a glass differing from that shape in having a rim turned in at the bottom, and a tube at the top, to which a receiver is fitted as an enlargement of the capacity of the vessel; others a retort with its bottom cut out, and a glass body or tubulated receiver applied to its neck; others a receiver, with a hole in its bottom for admitting the flame; others a glass body, with some water in its bottom, holes in the sides, a crucible with burning sulphur placed in the water, and another body inverted on the mouth: some have suspended the burning sulphur in a wooden cask half full of water, and afterwards rectified the liquor. The grand difficulty is, that sulphur will not burn without a draught of air, and the acid fumes are so volatile that far the greatest part of them is carried

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ed off by the air. Some direct a little nitre to be mixed with the sulphur, to promote its burning; but though nitre is undoubtedly of advantage in that respect, it is injurious in another; rendering the product impure, by giving out its own acid along with that of the sulphur. Many other contrivances have been made, but none with any commendable success; the same acid being obtainable at a much easier rate from vitriol, than by any methods of procedure to which sulphur has hitherto been submitted. The best way hitherto discovered of collecting the acid spirit of sulphur in a volatile state, is that given by Stahl: the sulphur is made to burn slowly by means of a wick, a number of alucobals set over it, and a cloth moistened with a strong alkaline-ley placed in each funnel: as soon as any of the cloths become dry, a moist one is put in its room. The alkaline salt which the cloths were impregnated with, imbibes the acid fumes, and is thus converted into a neutral salt, which is easily rubbed out. It is the volatile vitriolic acid that this salt contains; and hence, upon adding to it a common oil of vitriol, in a tabulated retort, the volatile spirit distils, leaving

the alcali combined with the more powerful fixed acid superadded. The volatile, however, as well as the fixed acid, is still more commodiously and advantageously obtainable from vitriol itself.

Sulphur unites in the fire with most metallic bodies, promotes the fusion of the refractory ones, iron and copper, renders lead on the other hand almost unfusible, and debases the quality of them all. It changes several into the appearance of their ores; silver, into a soft leaden coloured substance, resembling the malleable silver ore; iron and copper into yellowish concretes, like the natural pyritæ; the antimonial regulus into antimony: quicksilver and arsenic into red compounds, the same with the native cinnabar and red arsenic; lead into a dark coloured mass, like its common ore; tin into a substance like antimony, a form in which that metal is never found in the earth. Pure silver does not act upon gold, but sulphurated alcali or hepar sulphuris unites with gold in fusion as well as with other metals and renders it dissoluble in water so as to pass through the pores of a filter. The principal use of sulphur is in fire-works and for making gun-powder. It is like

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wise employed in some woollen manufactures in bleaching, for making cinabar, by the wine-coopers, for sundry economical and other like purposes. It is used medicinally against cutaneous eruptions, and disorders of the lungs: from the virtues attributed to it in this last intention, it has received the name of anima pulmonum.

OF ARSENIC.

ARSENIC is extracted from a mineral called cobalt, in Bohemia and Saxony. When mixed with calcined flints and pot-ashes, the mixture, in a very strong fire, will turn into a glass of a blueish colour, that when reduced to powder is called smelt. In the preparation of this glass a copious smoke is exhaled, which sticking to the sides of the furnace, and collected together, appears in the form of a white powder; which being put into a crucible, and melted in an exceeding strong fire, turns into a white heavy glassy mass. This is called white arsenic, and is a most dangerous poison. But by adding to ten parts of the former, one of sulphur, melted as before, then yellow arsenic will be produced.

duced. If two parts of the sulphur are added to ten of the powder, and melted as before, it will become a reddish mass, which goes by the name of red arsenic.

OF COBALT.

COBALT is a fossile body, heavy, hard, almost black, and not very unlike antimony; when kindled in the fire, it has a sulphureous nauseous smell, and is generally mixed with a portion of brass, and sometimes a little silver. Cobalt is found in some parts of England, particularly in Mendip hills in Somersetshire; but it is not thought so good as that of Saxony. The cobalt mines of Schneeberg, in Saxony, are said to be two or three hundred fathoms deep.

OF AMBERGRIS.

THIS is a marine bitumen, about the consistence of wax. It springs from the body of the earth; is sometimes found in the sea, condensed and floating on the water; sometimes thrown out upon the shores, and sometimes met with in the bodies of whales and other fishes. The greatest quantities of ambergris are found

found in the East Indies, about the island Madagascar, the Molucca Islands, the western Sumatra Islands, and on the Ethiopian coast. Ambergris is of various colours, but the ash-grey-coloured, with whitish, blackish, and yellowish streaks or specks is deemed the best. The best ambergris is light, like wax to the touch, crumbly, yet somewhat tenacious, so as to stick to the mortar or pestle: it has an agreeable smell, but no remarkable taste: it easily melts in the fire, takes flame from a candle, and burns away without intermission. Ambergris is used principally in a perfume, in balsams, snuffs, wash-balls, &c. It was formerly held in some esteem as a medicine, and said to possess nervine, analeptic, cephalic, and other virtues; but it is little regarded at present. Common water, distilled from ambergris, proves considerably impregnated with its fragrance. A tincture of ambergris is sometimes prepared with spirit of roses.

OF AMBER.

AMBER is a pellucid and very hard inflammable substance, brittle, and generally of a yellow or citrine colour; though

though sometimes it is whitish, and sometimes brown. The taste is somewhat acrid and bituminous, with a little astringency; the smell, when warm, is fragrant and bituminous; and, when rubbed, it is highly endowed with that remarkable property called electricity.

Amber is a solid mineral bitumen, and is found in great plenty in regular mines in some parts of Prussia. The digging of amber is a very dangerous employment; the ground not being rocky or stony, as in metallic mines, but sandy or loamy, and hence very subject to fall in when hollow underneath. The king of Prussia receives a large annual revenue from this commodity: he has a peculiar council, called the amber-chamber; and only those appointed for that purpose are permitted to dig or fish for amber in his dominions. Small quantities of amber are met with in Bohemia, Silesia, Saxony, Hungary, France, &c. Various kinds of substances are often enclosed in masses of amber, as drops of water, which pass from side to side upon moving the mass, small bits of wood, moss, leaves of plants, &c. a variety of insects, particularly flies, gnats, spiders, ants, moths, butterflies, grasshoppers, bees,

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worms, &c. It has also been reported, that frogs, vipers, fishes, and other large animals, have been found in masses of amber.

It is evident that this bitumen has once been in a fluid state, though we cannot conclude, that it ever was a liquid or oily matter, and acquired its consistency and solidity by degrees. Appearances are rather contrary to this supposition. The insects found in amber have nothing of those strained or distorted postures, which animals are naturally thrown into, upon endeavouring to disengage themselves when entangled in a viscous liquid. We often see pieces of amber in which there are perfect flies, with the wings and feet beautifully expanded, as if they were still flying. It is therefore most probable, that the amber was generated instantaneously from the concurrence of mineral oil, with vitriolic acid, in the form of vapours, which at once concreted together, and embalmed the insects that happened to lie in their way, with a more durable and precious covering than has ever fallen to the lot of the most magnificent monarchs: there are different sorts of amber in regard to external appearance; opaque and transparent;

rent; white, or whitish; yellow, or yellowish; greenish, brownish, blueish, reddish, or brownish red. What is called black amber, is not the true amber, but bitumen of the pit-coal, asphaltum, or jet kind.

P I T - C O A L.

PIT-COAL is universally known in this country, and when distilled in a retort, first yields a phlegm, then a sulphureous spirit that is a little acrid, which is afterwards succeeded by a subtile oil, and then one that is thick, which sinks to the bottom. With the greatest degree of fire there is produced a sort of an acid salt, like that of amber, leaving behind it a light black earth. When the spirit is thrown on quick lime, it becomes volatile, and strikes the nose with a strong smell; spirit of nitre being added to this, a white smoke will arise, which yields a very pleasant sight. The fetid oil being mixed with salt of tartar, has the smell of a volatile salt, and when this mixture is distilled, it yields an alkaline, volatile, oleous spirit, which will turn syrup of violets green; but if it be mixed with an acid, it will immediately ferment,

ferment, and become of a bright red colour. The thick oil of coals has a sulphureous smell, and being put into a silver spoon, with a gentle heat, will turn it blackish, which is a certain sign there is a true mineral sulphur contained therein; for common sulphur, dissolved in oil of turpentine, will do the same. Hence it is plain, that coals contain nothing that is unwholesome; nor is there any arsenic at all in them, though some have supposed the contrary. Nor yet is the mineral sulphur which they contain so hurtful as some have imagined; for those that are employed in the melting and preparing sulphur are as well, and in as good case as other people, and much better than miners of other kinds. Coals are so far from doing any harm, that they are rather beneficial, by drying up the too great humidity of the blood, and preserving the body from putrefaction; for it has been observed by Galen, that all bitumens, being kindled, mend the disorders of the air, by dispersing their too great humidity; which opinion has been hitherto followed by all physicians. Where the atmosphere is very moist, and full of watery vapours, so hurtful to human bodies, the burning of coals is certainly

tainly very proper. In former times, when the plague and other infectious diseases were common, they used to burn bitumen to purify the air; and this is certain, that in London, since the burning of pit-coal has been almost universal, no plague has ever affected that city, nor any disease of that kind; and therefore there is no reason to be afraid of it, unless it be brought from other countries.

There are mines of coals dug in various parts of England, which generally differ, in some respect, from each other; those brought from Newcastle, improperly called sea-coal, are remarkable for their being generally small, and caking on the fire. These are the best for boiling flesh, which others, in various parts of the kingdom, will not do, particularly in Staffordshire. Kannel coal, which is dug up in Derbyshire, and other places, is famous for its fineness, as well as hardness, though it will burn like a candle; there are now several things made with it, such as the tops of snuff-boxes, salt-cellar, and the like. It is also found in Staffordshire, and it is remarkable, that the choir of the cathedral church of Lichfield is paved with it; that is, the black part with coal,

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and the white with alabaster, which look like black and white marble. It will turn, like ivory, into ink-pots and candlesticks; and some have their coats of arms carved thereon. The other coals most used in London are brought from Wales and Scotland, and are valued for burning clear without a great deal of smoke.

OF ANTIMONY.

ANTIMONY is sometimes found in a particular ore, but generally mixed with other metals. It is called *fatanus devorans*, and *lupus philosophorum*, from its power of devouring or destroying as it were all metals when in fusion with it.

Its chymical character is a circle, denoting the body of gold, and a cross to shew it is corrosive.

There are mines of antimony in Hungary, Transylvania, Germany, France, and in England some are met with. The French antimony is about equal parts regulus and sulphur; but the best is from Hungary. The English is, of all the sorts, the least fit for medical use, for it is often mixed with lead or tin, from which, however, if separated, it is as
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good as any other : that which is spotted with red, Dr. Alston, of Edinburgh, is of opinion is possessed of some arsenic, and should be rejected.

The antimony is generally found mixed with hard stones or spar, from which it is separated by eliquation ; some ores are mixed with arsenic or with cobalt ; some is dug up which is composed of fine shining lines like needles, sometimes disposed in regular ranks, at others without any observable order ; this is termed male antimony ; some is disposed in thin broad plates or laminæ, and is called female antimony by Pliny : and from its different mixtures and appearances other names are given to it.

The mineral being broken into pieces, it is put into earthen pots whose bottoms are perforated with small holes, and a moderate fire is applied round them ; as the antimony melts, it runs through the holes in the bottoms of the pots, and is received into conical moulds placed underneath ; in these moulds the lighter and more drossy part rises to the surface, while the purer and more ponderous falls to the bottom ; whence it is that the broad part of the loaves are less pure than the apex or smaller end. The antimony

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thus separated from its ore, is called crude, which yet is but an ore, or a combination of a particular metal with common sulphur.

The goodness of crude antimony is discovered by its weight, from the loaves not being spongy, from the largeness of the striæ, and from its totally evaporating on a strong fire.

Its general appearance is a ponderous brittle mineral, or semi-metal, composed of long shining streaks like needles, mixed with a dark leaden-coloured substance, and hath no particular taste nor smell, and is brought to the shops in the form of conical loaves.

Antimony, like most of the best medicines, found its way as an internal in the medical practice with great difficulty; the antients considered it as a poison, and only fit for external uses. Basil Valentine, in the fifteenth century, first brought it into vogue as an internal medicine, but it soon lost its repute, till Paracelsus raised its credit again, after which it was received and rejected several times, until, by the success of empyrics, it received an established place in regular practice; and is now justly

ranked with the most valuable part of the materia medica.

The crude antimony, if made into an exquisitely fine powder, is in many disorders, as efficacious as any of its preparations ; in numbness and pains of the limbs, which follow a salivation and other causes, three grains may be given three times a day, gradually increasing the dose by one grain at a time, until it amounts to half a dram, then gradually lessening it by the same proportion as it was increased : in the paresis and palsy the same method is also effectual.

The preparations of antimony are, in general, used both as alteratives and evacnants, and hardly any article in the materia medica will admit of so extensive a use as this ; in acute diseases, as well as chronical, it is equally a principal in the cure, the varieties of these complaints only requiring some difference in its adjuncts. In fevers of the inflammatory and putrid kinds, it is alike the proper remedy ; and in chronical diseases, whether from the rigid or lax habit, it is also to be depended on.

It promotes all the secretions and excretions, particularly those of the skin, intestines, urinary passages, and salivary ducts,

ducts, by gently irritating the whole nervous and vascular compages. If given in small doses, gradually increasing them, yet keeping to that proportion which excites no sensible discharge, it is a most effectual remedy for regenerating an healthy state of the blood, such a one as will maintain the vital heat in a natural way; for this purpose its effects are not so speedy as those of iron, but they are more lasting.

Thus it is easy to perceive how justly it is asserted to be curative in so many disorders, and those too of opposite natures. As an auxiliary to other medicines, on which the cure more directly depends, its efficacy is no less to be admired; it quickens their action, and increases their powers, particularly those by which any evacuation is to be promoted, mixed in under doses with such medicines: their operation is generally more easy too; of itself it excels as an expectorant, and some of its preparations provoke the salivary glands, as when mercury hath been freely taken; but the discharge made by antimony is ropy, whereas that with mercury is very thin.

If any preparation of antimony is too free in its operation upwards, it may be

carried through the intestines by taking a little common salt in any small drink made warm, or it is restrained by a draught of water acidulated with the elix. vitrioli acidum.

The preparations of this drug are numerous, but except that which is called the antimonial caustic, they only differ from each other in their degrees of activity: the caustic, the antimonial wine, and emetic tartar, are the only ones that deserve our notice, out of the great variety which swell the dispensatories. Besides these, we may indeed add two private prescriptions which are deservedly celebrated, viz. the febrifuge powder of Dr. James, and that of Edinburgh, the latter of which is recommended to us on the best authority, as possessed of those very desiderata, the want of which was the cause of other preparations being complained of.

After naming some of the pharmacæutic properties of crude antimony, the chief of its preparations follow.

It consists of a metallic part, called its regulus, and of common sulphur. Newmann, and some others, assert, that its emetic and cathartic qualities are owing to a small portion of arsenic contain-

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ed in it ; but this is objected to from observing that the ill effects of arsenic are very different from those of antimony ; and again, that the activity of antimony is destroyed by means that have no such effect on arsenic.

It is easier of fusion than its pure metal.

It melts before it is red hot, but not before its containing vessel is so.

All its medicinal virtue is in its metallic part.

Water neither dissolves the sulphur nor the metal.

Rectified spirit of wine affects not the metal, but takes up a small portion of the sulphur.

Wine, or any vegetable saponaceous acid, acts on both the sulphur and the metal.

Oil of vitriol takes up the inflammable part of this semi-metal, and unites with it into an actual mineral sulphur.

The muriatic acid, and the aqua regia, are its proper solvents ; the other dissolvers of metals convert it into a calx.

Crude antimony is volatile in the fire, and volatilizes all metals except gold, so as to make them fly away with it in the form of a vapour ; hence its use in refining gold.

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The solution of it in aq. regia, or in spirit of salt, is precipitated by the addition of water.

When united with sulphur, or partly calcined with nitre, its virulent activity in the primæ viæ is much abated.

When entirely deprived of its phlogiston by calcination, it becomes quite inert, acquiring additional weight.

It is soluble in hepar sulphuris.

Antimony, says Geoffrey, is the most excellent emetic we have, and the most sovereign remedy in many diseases, when rightly exhibited. In giving emetics, three things are to be considered; the patient, the disease, and the medicine. We ought, first of all, to be informed, whether the patient vomits easily: some persons cannot be made to vomit with any dose of an antimonial medicine; some are so weak as not to be able to bear the fatigue and straining of a vomit at all; some are so subject to a spitting of blood, that, by giving them a strong emetic, a fatal hæmorrhage might ensue. We ought likewise to know, whether the patient has any considerable hernia, in which case violent vomiting might produce very dangerous consequences; whether the vessels be so full, as that a
rupture

rupture of any of them may be apprehended; and lastly, whether the patient, if a woman, be with child. In all these cases, vomits seldom ought to be ventured upon, and never without taking the greatest precautions.

The second thing to be considered, is the disease itself; and especially, whether the seat of it be in the blood, or in the primæ viæ; the last of which may be discovered by a bitter taste in the mouth, nausea, bilious eructations, acid vomiting, &c.

Some imagine, that emetics can be of no real service when the morbid matter has reached the mass of blood, or when the disease proceeds from an ataxia, or depravation of the spirits, as in many spasmodic, hysterical, and hypochondriacal affections: but this is a mistake; for we find, antimonial vomits are given with very great success in such cases; not so much as they evacuate what was before contained in the stomach, as by deriving the morbid matter from the principal parts; the lungs, for instance, or pleura, when threatened, or actually affected, into the abdomen, from whence it is easily and readily carried out of the body. And, for this reason, Hippocrates,

crates, very wisely, advises to have recourse to vomits in the beginning of such diseases. In convulsions an emetic, by applying a stimulus to the fibres, of a contrary nature to that from whence the disorder proceeds, very often gets the better of that morbid cause, and thus cures the disease: for the same reason Hippocrates gave emetics in diarrhoeas and dysenteries, that the tendency of these evacuations might be directed upwards, and so destroyed. In comatose affections, emetics powerfully shake the viscera, increase the oscillations of the nervous fibres over the whole body, and accelerate the motion of the fluids, or restore it, when lost, in any particular part, so as to make them pass through the smallest canals to their proper emunctories. Thus we often see one dose of an antimonial emetic prove likewise cathartic, sudorific, &c. in a very plentiful degree. In giving these emetics, great care ought to be taken, that none of the abdominal viscera be inflamed; because such inflammations might very probably be increased by the strain of vomiting. We must not likewise be misled by all kinds of reaching, or attempts to vomit; for these are many times owing to convulsive contractions

contractions of the stomach, which by giving an emetic may be increased, or perhaps that whole bowel may be inflamed.

Thirdly, such preparations of antimony are to be chosen as may be given with safety, of which the dose may not be too great for the strength of the patient, and yet may answer the intention of the physician. Antimonials given in powders often disappoint physicians, either by vomiting too much, or not at all. The effects of antimonial wines are very uncertain, because of the different qualities of wines: but the most excellent preparation of this kind is emetic tartar, which ought always to be given, dissolved in a proper liquor, and not in too small a dose; because if it is not strong enough to have the desired effect, it will be apt to fatigue and torment the patient with fruitless nauseas and reachings. Too great a dose may likewise be dangerous, by exciting two violent contractions in the stomach, and strainings of other viscera, so as to cause spitting or vomiting of blood, long continued reachings without bringing up any thing, convulsions, and inflammations of the viscera.

If from any dose of antimonial preparations, either too violent or too long-continued

continued vomitings should happen, the best method is to drink a glass of water or ptisan, acidulated with a few drops of ol. sulphuris per campanam, or spirit of vitriol; which will presently check the emetic quality of the antimony, and stop the vomiting much more safely than opium.

While the emetic works, the patient ought to drink very plentifully, either luke-warm water, whey, or veal, or chicken-water, with a view both to dilute the contents of the stomach, to be thrown up, and to make the vomiting more easy, and less straining. On the other hand, oils, and all fat substances check the force of the emetic too soon, and prevent the dilution of the contents of the stomach, and are therefore to be guarded against.

Besides the medicinal uses of antimony, it is employed by several artificers to give the silver sound to tin, in casting bells, making metalline specula, and types for printing, &c. It is likewise used by goldsmiths in refining gold; for when melted with that metal, it destroys all other metals that can be mixed with it, silver itself not excepted, and turns them to dross.

The metallic part of antimony is what is called the regulus of antimony. It is a metal of a particular species, of a bright white colour, a leafy texture, very brittle, near seven times specifically heavier than water, and melts in a low white heat; if continued in fusion, in an open vessel, it gradually exhales in thick white fumes; melted with common sulphur it becomes similar in appearance and qualities to the crude antimony; no known art can render it malleable; in it is contained all the medicinal qualities of antimony; it is corroded by the vitriolic and nitrous acids into a white powder, but the marine acid perfectly and properly dissolves it; it will not dissolve in aqua fortis, nor is it so readily soluble as the glass of antimony.

The largest quantity of regulus hitherto obtained from antimony is by calcining it without addition, as in making the glass of antimony, and then reviving the calx by fusion, with an equal weight of the black flux. As soon as it is fluid, pour it into a cone, and the pure regulus will fall to the bottom.

The regulus of antimony hath been cast into pills, in which form it hath acted as a cathartic. These pills being

separated from the stools after their discharge, they have been taken again and again with the same effect, but without any sensible loss of their weight or quality. These pills are called perpetual pills. A cup made with this regulus was called the antimonial cup; wine poured into it presently became emetic, and no loss of the cup was observed thereby.

OF BISMUTH.

THIS is also called marcasite of silver, and tin glass.

It seems not to have been known to the Arabians; their marcasite was the lapis pyrites. Some reckon it a species of tin. It is a bright pale lead-coloured mineral; when broke, it appears of a silver white; it may be powdered without difficulty; it is nearly ten times specifically heavier than water, of a flakey contexture; its earthy part affords a good blue as that from cobalt; it is mixed with sulphur and arsenic; by fusion the sulphur and arsenic evaporate, and the metallic part runs off from the earthy. In Cornwall there is much of this mineral; sometimes it is found mixed with the cobalt. Bismuth is easily
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separated from its ore by means of fusion with the common black flux. It melts long before ignition, a little sooner than lead, but later than tin. A strong fire sublimes it into white flowers; it is convertible into a glass by heat alone. The nitrous acid dissolves it, from which it precipitates in the form of a bright white powder, by dilution with water. The marine acid does not readily affect it, and the vitriolic scarce at all. It impregnates the vegetable acid with a nauseous taste. The chief of it that is brought into England is from Saxony. Dr. Alston denies that the ores of bismuth contain any arsenic; it is true that the bismuth, when brought to us, is without such particles.

It mixes easily with several metals, but destroys their ductility. It promotes the fusion of other metallic bodies. Mixed with lead and tin, it forms a compound that melts with a very small heat; the following proportion is so fusible, that it hath been proposed for injections, two parts of lead, three of tin, and five of bismuth. If bismuth is mixed with lead, a larger portion of the latter can be combined with quicksilver, than can be without this method; and the quicksil-

ver cannot be freed from this mixture by the common methods.

OF BITUMEN.

THIS is also called carabe of Sodom, fossile pitch, and Jews pitch.

It is a mineral sulphur. It is a solid light substance, of a dusky colour on the outside, and a deep shining black within, having but little taste or smell, except it is heated, in which case it emits a strong pitchy odour. It is not soluble in oils, nor in vinous spirits; it melts but imperfectly in the fire. On burning it, a large quantity of ashes are left behind. It is found in the earth in many parts of Egypt, and floating on the surface of the dead sea. At first it is soft, but grows hard by keeping.

The genuine sort is generally supplied by different bituminous substances found in Germany, France, and other countries; but these substitutes have a stronger pitchy smell than the true sort hath. They are further distinguished from the true, by their more perfectly dissolving with heat, and by their not leaving so many ashes behind when burnt. Neumann says, that when the genuine bitumen

bitumen is distilled in a retort, it yields a light insipid phlegm, about 1-11th its weight of an oil, that resembles the native petrolea, but of a more disagreeable and empyreumatic smell; and any of the above substitutes may well be admitted. Fossil pitch is found in many parts of this island in the seams of lime-stones. The virtues of all these substances depend on the quantity of petroleum which they contain.

The asphaltus is a species of bitumen, of which Dr. Shaw, in his travels, gives the following relation; this author, speaking of the dead sea, says thus:

I was informed, that the bitumen, for which the lake hath been always remarkable, is raised at certain times from the bottom in large hemispheres, which, as soon as they touch the surface, and so are acted upon by the external air, burst at once with a great smok and noise, like the pulvis fulminans of the chemists, and disperse themselves round about in a thousand pieces. But this happens only near the shore; for in greater depths, the eruptions are supposed to discover themselves only in such columns of smoke, as are now and then observed to

arise from the lake. And perhaps to such eruptions as these we may attribute that variety of pits and hollows which are found in the neighbourhood of this lake, and compared, very justly, by Mr. Maundrell, to those places in England, where there have been formerly limekilns. The bitumen, in all probability, is accompanied from the bottom with sulphur, inasmuch as both of them are found promiscuously upon the wash of the shore. The latter is exactly the same with common native sulphur; the former is friable, heavier than water, yielding upon friction, or by being set on fire, a fetid smell. Neither doth it appear to be, as Dioscorides describes his asphaltus, of a purplish colour, but is as black as jet, and exactly of the same shining appearance.

OF CINNABAR.

CINNABAR is either native or factitious. The native cinnabar is an ore of quicksilver moderately compact, very heavy, and of a peccant striated red colour. In this ore the quicksilver is mixed in different proportions with sulphur.

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hur. It is such an ore, as to be no other than mercury, impregnated with a small quantity of sulphur; just enough to shew it in that state; being usually more than six parts of mercury to one of sulphur: even the poorest cinnabar yields one half mercury. When fresh broken, it is of a very bright glittering appearance; and is generally found lodged in a blueish clay, though sometimes in a greenish talky stone. Factitious cinnabar is a mixture of mercury and sulphur sublimed; and thus reduced into a fine red glebe. The best is of a high colour, and full of fibres resembling needles. This, as well as the native cinnabar, is excellent in epilepsies, and all complaints of the head and nerves: but the factitious is rather to be preferred.

Cinnabar is also used by painters, as a colour, and is rendered more beautiful by grinding it with gum water and a little saffron.

OF QUICKSILVER.

SOME dispute its being a metal; others assert it to be a proper one: it hath all the properties of metal except mal-

malleability, and according to the experiments of professor Braun, it is rendered malleable by exposing it to a due degree of artificial cold, that is, to about 528 below the freezing point on Fahrenheit's thermometer, whence it may properly be deemed a perfect metal.

In the Venetian territories there are the greatest quantity of mines producing quicksilver; we have much from the East Indies; Spain and Hungary afford great quantities of it; in China, Japan, and many other places, it is met with; and about Montpelier, in France, there are some mines in which it is found.

It consists of a volatile vitrifiable earth and sulphur.

It is found in the earth in a fluid form sometimes, and so pure as not to need any refining; it is then called virgin quicksilver; but it is usually found mixed with other substances: the most general state in which it is met with in the mines is mixed with sulphureous ores, of a red colour, called cinnabar, and the richer the ore, the redder it is.

It is separated from the ore by washing in water; grinding with vinegar and a little salt, which dissolves the metalline impurities; and by distillation either a-

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alone or with the addition of lime, potash, or iron filings.

Those who work in the quicksilver mines soon die; at the first of their being affected they are seized with tremors, after which a salivation comes on, their teeth drop out, and pains seize them all over, particularly in the bones.

Hippocrates appears to have been unacquainted with this mineral; Aristotle and Dioscorides rank it amongst poisons; Galen says it is corrosive; Mesue, the Arabian, was the first who used it medicinally, and he only applied it in the form of an ointment in cutaneous distempers. Avicenna observes, that it may be swallowed crude, and that it passes through the body. About the end of the thirteenth century it was introduced into Europe as a medicine, but not esteemed a safe one, until the venereal disease was brought over, and was found to yield to its efficacy. The first internal mercurial medicine which gained real credit was the pilul. Barbarossæ, which was composed of quicksilver, rhubarb, musk, &c.

Quicksilver is the heaviest of all bodies except gold. Gold is to mercury nearly as 4 to 3.

When

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When well purified it is as simple as pure gold.

It is totally volatile in the fire by heat not much greater than that of boiling water, and by a far less heat it is calcinable into a red powder.

The fumes raised by fire are scarcely visible, and yet by being received into cold water may be reduced to the state of pure quicksilver.

It amalgamates most readily with gold, next with lead, next with silver, next with tin, scarcely at all with iron, and with great difficulty with copper.

By the assistance of trituration, or of heat, it dissolves all metallic bodies except iron.

The vitriolic acid hath no effect upon it till it is concentrated by heat; the nitrous acid acts quickly upon it; fixed salts make no impression, and the spirit of salt hath little or no effect upon it; vegetable acids have as little; nor do neutral salts alter it any way. It is allowed to be pure, when a little held over a fire in an iron ladle totally evaporates. It is often adulterated with lead, a large quantity of which may be incorporated with it by the intervention of bismuth in a moderate heat; and in this case the
lead

lead cannot be separated by pressure thro' leather. This abuse may be discovered by the mercury staining paper blackish; by its not running into round globules; by its leaving a powdery matter or a coloured spot on the bottom of the vessel; and by its producing a turbid milkiness during its dissolution in aqua fortis.

As a medicine it is used to promote the secretions in general, particularly the saliva. The more perfectly it is divided the more powerful and penetrating is its action, which is chiefly exerted in the small lymphatic vessels. Whether used internally or externally it liquefies all the juices in our bodies, and may be so managed as to promote excretions thro' all the emunctories. If not restrained it first fuses the humours, then determines them to the mouth, and causes inflammation, tumours, and ulcerations there.

It hath been swallowed crude, as an universal remedy.

The true secret of curing diseases with mercury is to cause it to circulate with the blood as long as possible, without producing any evacuation at all.

A long use of mercury weakens the habit, and so should be accompanied with mild

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mild antimonials, the bark, or sarsaparilla, &c. as circumstances seem most to require.

Quicksilver is divided by earthy powders, balsams, mucilages, &c. but with nothing more advantageously than the mucilage of gum arabic. Mr. Plenck, of Vienna, directs a dram of it to be mixed with two drams of gum arabic in powder, by degrees to add a little water, and to continue the trituration of them together until the globules totally disappear, after which half an ounce of any syrup and half a pint of water may be added, and two common spoons full of the mixture may be taken every night and morning in such cases as require its use.

Gum arabic powerfully restrains the mercury from running off by the salivary glands; and if a salivation is already excited, it is the best assistant in checking it.

Crude mercury in general is of equal advantage with any of its preparations; yet, in particular constitutions, one or other of them may demand a preference.

OF GOLD.

THIS metal is found more or less in every country ; but the greatest part of what we have comes from America, particularly from the mines of Potosi ; but the Asiatic is esteemed the finest. Sometimes it is found pure and unmixed, in small grains or in large lumps, and is then called virgin gold ; but it is usually found in ores of different kinds, to separate it from which various methods are required ; its chief matrix is flint. All sand contains a greater or lesser quantity of it.

Gold is a yellow metal, nineteen times heavier (specifically) than water.

Its ductility is such as to admit of one grain of it being drawn out to the length of five hundred feet, which no other metal will : indeed it is the most divisible of all bodies, if melted with 100,000 times its weight of silver, it will be so perfectly blended with it, that any grain of the melted mass is, on assaying, found to contain its portion of gold : a single drop of its solution in aqua regia, gives a metalline taste to a pint of the rectified spirit of wine. It is so ductile, that the

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wire.

wire-drawers can extend a leaf to the 12,000,000th part of an inch in thickness, over a flattened silver wire, which will be perfectly covered though viewed with a microscope. One grain of gold may be so beat out as to cover a large house, and still to be so compact, as not to admit of the rays of light through it. The force of cohesion in gold depends on its freedom from sulphur: for one grain of sulphur mixed with 1000 grains of pure gold, destroys its malleability.

It is fusible in a low white heat, requiring more heat to melt it than tin does, and less than iron or copper. It turns white before it melts.

It is fixed and indestructible by the fire; it suffers the heat of the greatest burning glass a long time before it evaporates. Antimony, which dissipates all other metals, leaves gold behind it. It is the only metal that resists the force of lead and glass of lead in fusion.

It is not soluble in any of the simple acids in the common ways of making solutions: but easily dissolves in a mixture of the nitrous and marine acids called aqua regia; it is the sea-salt in this that dissolves this metal, for hardly any other salt will affect gold: but though aqua

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regia is the common solvent of gold, it is not the only one; for the fumes arising from a mixture of the oils of tartar and of vitriol will dissolve it, and a common liquid menstruum may be produced from these, which will have the same power. Mercury is also a solvent by amalgamation. And the liver of sulphur fused with it, takes it up so perfectly, that it will be carried into a milk of sulphur, by the common process afterwards with it. It may also be calcined by common sulphur, if set on fire and flaming.

It is the heaviest and most dense of all bodies.

After repeated refinings, some silver is still found adhering to it: yet it is the most pure of all natural bodies.

It cannot be resolved into more simple principles than those of itself.

If pure it sounds but little, is softer than lead, and scarce elastic. The alloy in gold renders it more fit for many uses, but its cohesion is greater in its pure state, consequently would be less subject to wear, if coined into money without the alloy.

It readily amalgamates with pure quicksilver.

When in fusion, it readily mixes with silver; and thus mixed it will run into a mass with iron, but more easily with copper.

Its colour and beauty is not injured by the air, or any of the damp, &c. that usually float in it. It is neither disposed to tarnish itself, nor to discolour other things: gold and gilded things are only sullied by the adhesion of other bodies, which may be washed off by their proper solvents, without affecting the gold, however thin it may be spread.

If essential oils are shaken with a solution of gold in aqua regia, they imbibe the gold from the acid, and carrying it up to the surface, keep it there a while dissolved; but gradually throw it off again, on standing for some hours, in form of bright yellow films, to the sides of the glass. Æther, though so light a fluid, takes up the gold still more readily and compleatly, keeping it permanently dissolved. Rectified spirit of wine mingles uniformly with the acid solution, but after having stood some days, the gold separates and rises in films to the surface. Tin put into a solution of gold in aq. regia precipitates it.

It was the Arabians that introduced gold into medicine: Avicenna esteemed it for its cordial quality; but as no means are yet discovered by which to separate its component parts, and it is insoluble by any of the animal fluids, its medical power can only consist in its being an antidote to poverty.

If one part of pure gold be calcined with five parts of tin, a powder is produced which is useful in forming artificial rubies and amethysts. And when dissolved in aqua regia it will dye skins, bones, and ivory, of a durable purple colour.

Gold is volatilized by mixing it with arsenic, or take the merc. cor. alb. rub it well with gold, first reduced to powder, then distil in a retort with regulus of antimony, and the body of the gold will ascend in the form of a red oil, and be perfectly volatile.

OF SILVER.

SILVER is sometimes found pure in the mine, but generally mixed with tin or lead. To the ore there often adheres a corrosive bituminous sulphur, which in fusion renders the silver volatile,

tile, or converts it into a glossy scoria: this loss is prevented by first roasting the ore, then reducing it to powder, afterwards adding mercury, and grinding them so long together, that the silver becomes wholly united to it, which may afterwards be separated by distillation.

The greatest mines are found in Chili and Peru, and there they separate it from the other mineral matters by pulverization, ablution with water, and amalgamation with mercury. The silver mines in England, Germany, and other parts of Europe, afford it mostly in an ore of a yellow, red, brown, or blackish colour, from an admixture of arsenic, sulphur, or both; and this ore requires a calcination for the dissipation of the arsenic, &c. and then the silver is separated from the remaining earth by fusion.

By means of lead it is separated from all baser metals, and from gold by dissolving it in aqua regia. It turns to scoria, and becomes volatile if fused with antimony.

It melts with nearly the same heat as gold, and is the next to it in ductility.

It is the next to lead in point of gravity.

It turns yellow and then black from the vapours of brimstone, or any sulphureous

phureous steams, as from vaults where filth is deposited, &c.

It is eleven times specifically heavier than water.

It is fixed, and indestructible by the fire.

It is soluble only in the nitrous acid, with which it unites so strongly, that a heat which fuses the silver will not part them. In the nitrous acid, it is dissolved into a limpid fluid, which stains the solid parts of animals black, is corrosive, and intensely bitter.

Though not soluble in the vitriolic or the marine acids by a moderate digestion, yet it may be precipitated from the nitrous acid by them.

As it is insoluble by any vegetable or animal juice, if swallowed, it is neither useful nor hurtful. Its only medical use is as a caustic, for which purpose that preparation called the lunar caustic is made.

OF LEAD.

LEAD is a pale or livid white metal, soon losing its brightness in the air, and contracting a blackish or greyish colour. It is very soft and flexible, unelastic,

unelastic, and unsonorous. It is the heaviest of all metallic bodies, except gold, quicksilver, and platina: it is upwards of eleven times heavier than an equal bulk of water. It melts in a very moderate degree of heat, and long before it grows red-hot: in a strong red heat it emits visible fumes.

If gold or silver be mixed with lead, and exposed to the fire, the lead scorifies, as it would by itself, and arises to the surface, so as to be raked off in the form of glass or litharge; at the same time carrying with it an imperfect metal that the gold and silver had been mixed with, but leaving those perfect metals themselves unhurt. Hence gold and silver are purified by means of lead, from mixtures of the baser metals. The litharge met with in the shops is produced in those works where gold and silver are thus purified; and contains the heterogeneous metals which the gold or silver had been mixed with. Lead exposed for some time to the steam of vinegar, or other vegetable acids, is gradually corroded into a white calx, which is the ceruss or white lead of the shops. The effects of lead on the human body are dangerous to those who are exposed to its vapours in the

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the fire, and even those who grind its calces, minium, cerufs, and litharge for the painters, are subject to violent gripes and constipations of the bowels, contractions of the limbs, and other disorders. All the common lead ores contain some silver and copper.

OF TIN.

THE characters of tin are ; first, it is the lightest of all metals.

Secondly, It is the least simple of metals ; being brought by a small degree of fire to emit sulphureous flames, which are easily separable from the metalline part, and almost combustible.

Thirdly, It is hence less fixed in the fire than any of the other metals.

As it is, of all metals, the least fixed in the fire, and affords the greatest quantity of sulphureous fumes, it consequently loses most weight in the fire. The fume, thus emitted, seems to be the sulphur of the metal, which is pernicious to the lungs, as appears by those who are employed in melting tin, it usually giving them a pale ghastly complexion, and throwing them into a phthisis.

Fourthly.

Fourthly. It is soft, flexible, malleable, and may be drawn into wire, but not so well as iron; neither is it very sonorous or elastic.

But though it be the least sonorous of any metals except lead, yet, when mixed with other bodies, it may augment their sound; as in the composition of bell-metal. So, though it be but very little elastic in itself, yet, when mixed with other elastic bodies, it may increase their elasticity.

A body, Mr. Bøyle observes, by being associated with another, may have new properties and uses, and some of them quite different from what it had alone: thus two or more materials being conjoined, may be qualified into a third, by virtue of fresh properties thence accruing to the composition. As tin is flexible, and yields but a dead sound, who would imagine that one considerable use of it should be, to make a less yielding and better sounding metal more strong and sonorous? Yet bell-metal is principally composed of tin and copper.

Fifthly. It melts more easily than any of the other metals, long before it ignites, and with a degree of heat little
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greater than that of boiling water: it readily hardens again in the cold.

Sixthly. When crude, or accompanied with its adhering sulphur, it dissolves only in aqua regia; but, when purified of its sulphur by calcination, it dissolves even in vinegar, and requires only a small proportion of that solvent.

Acids do not dissolve it without great difficulty, especially the more powerful ones. The reason apparently is, it abounds with sulphur, which acids do not touch. It dissolves in aqua regia, scarcely in aqua fortis; which is a remarkable circumstance, considering the near alliance it has with silver. The weaker the acid menstruum is, the sooner and the easier it works its end; and the stronger, the more slowly: thus sour apples, and other unripe fruits, being boiled in tin vessels, will grow sweetish; but the strongest acids, boiled in the same vessels, make no solutions at all. But tin, freed by calcination from its sulphur, dissolves in all acids, and is reducible thereby to vitriolic crystals. This solution is little practiced, on account of the difficulty attending it; for the tin must be first thoroughly calcined, and the calcination

cination requires a continual fire for three days.

Seventhly. It so far endures lead and antimony in the refiner's test, as hardly to be separable from them, without the assistance of copper.

Eighthly. In many of its properties it approaches to silver.

If the sulphur could be perfectly purged out of tin, it is probable it might approach to silver; for, as it is, the two metals have several properties in common. Thus, when dissolved in strong acids, tin grows bitter, as well as silver; and, when it is fused with silver, it adheres so obstinately to it, that they can hardly be separated; and in such circumstances it resists lead, almost as much as silver does. Hence many account it an imperfect species of silver.

It may admit of some doubt, whether tin bears these resemblances to silver, by virtue of its being tin, or only by virtue of the particles of silver mixed with it. It is certain more of these resemblances, and those in a greater degree, are found in some species of tin than in others. Mr. Boyle mentions a gentleman, who, having procured a quantity of the nobler metals, from some tin-ore, long digested

in lixivate liquors, desired Mr. Boyle to purchase him a large quantity of it, in full expectation of raising an estate. But, says Mr. Boyle, after his first stock of ore was spent, the next that he procured, though managed with the same care as the former, proved wholly unprofitable.

He, in the same place, relates, that having dissolved some block-tin (that is, pure and unwrought) in a particular menstruum, which held it suspended; and, having afterwards evaporated the solution, and set it to shoot, he found, to his surprize, that the crystals it afforded were not all like its own kind of vitriol, but broad, flat, and thin, like those of silver: upon examining them by the tongue, they had nothing of the taste of calx of tin made in spirit of vinegar, but that excessive bitterness we meet with in the crystals of silver made with aqua fortis; and both of them presently tinged the nails and skjn with a black that would not easily wash off: whence he might have suspected, that the menstruum had exalted the metal into an affinity with silver, had he not afterwards prosecuted the same trial with the same menstruum, and another parcel

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of block-tin, and found, that though this metal was bought at the same place and very soon after the other, yet the former success proceeded from his having procured a lump of tin of a peculiar nature.

Some authors speak much of the analogy between tin and lead, and will have tin to be lead, only under a less degree of coction; but, if in some circumstances they correspond, they differ in others. Lead, for instance, is easily reduced to a calx, and tin more easily still; but the calx of lead readily melts, and runs into a brownish glass, whereas tin does not vitrify without much difficulty. Tin and lead readily mix and unite with each other by a gentle fire; but, if the heat be intense, there arises a colluctation between them, the effect of which is, that both fall into a calx, and that the lead becomes exceedingly difficult afterwards, to fuse and vitrify. The tin is easy to be revived, but the lead not without difficulty; nor is the restoration at all complete, or the new body in all respects like the old.

This is found in a very heavy ore, though itself be light; usually in a brown deep glebe, inclining to yellow; or in a black

a black smooth, shining one, which is the richest kind; sometimes like iron-stone; and sometimes it is also in a heavy porous stone.

The ore is principally found in Cornwall and Devonshire, whence all the rest of Europe is supplied with this metal. It is so much the peculiar product of this country, that Camden supposes it to have given the denomination Britain to the island. And Bochart derives the name Britannia from the Syriac barat anac, that is, fields of tin.

The metal is procured by roasting, grinding, washing, then melting the ore, and thus separating the scoria from it.

The stones from which tin is wrought, Dr. Merret tells us, are usually found betwixt the two walls of iron coloured rocks, of little or no affinity with the tin, in a vein, from four to eighteen inches broad: though, instead of stones, they sometimes, also, find it mixed with a small gravelly earth, generally of a red colour, but sometimes white. From the earth the tin is easily separated, by bare washing, which is called brian tin, and is not above half the value of the former.

In the tin-ore an hard, glittering, sulphureous substance, called mundic, or

maxy, is often found, which is commonly supposed to feed the metal; yet, where the mundic abounds, they rarely find much tin. The mundic is to be carefully separated; for, if the least of it be left, in melting the tin, it makes it brittle and cruddy, and diminishes much of its ductility.

There also occurs a sort of spar, of a shining whitish substance, soft and flat-tish at first, but soon after it becomes harder. It seldom grows, but only sticks to the metal. Some of the miners deem this the mother or nourisher of the metal. The best ore is that in sparks; and next to this, that which has bright spar in it.

The ore being dug, they break the greater stones, and thus carry it to the stamping or knocking-mill, where it is pounded with large lifters, of thirty or forty pounds apiece; and thus reduced to a small sand, to be washed out by a stream of water, discharged into it thro' a brass grate, into a launder, or trench dug in the floor, out of which the water escapes, carrying with it the parts not metalline, which they call the caustalty, and leaving the other at the bottom.

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To clear away the mundic, they dry or burn the ore, thus separated, in a kiln, upon iron plates, keeping the matter constantly stirring, that all the mundic may, by degrees, get uppermost, and so be burnt away; which they discover by the flames growing yellow, and the stench diminishing. Then they proceed to grind it again, very fine, in a crazing-mill; after which they wash it, then dry it a little, and, at last, carry it, thus prepared, to the furnace, which they call a bowling-house, and there melt, and cast it.

When it runs out of the furnace, there swims on it a dross, or scum, like that of iron; which, being melted down with fresh ore, runs into metal. The causality they throw on heaps upon banks, which, in six or seven years, they fetch over again.

The ore of tin is generally a black, ponderous, stony substance, appearing like black stones; but some tin-stones are yellow, and others white; some are brittle, and others extremely hard, so as to require being broke before calcination.

Tin is seldom used in medicine internally, though its virtues are highly extolled by some, but we fear upon no just

grounds; particularly in diseases of the head, the lungs and uterus, the falling-sickness, and the bite of a mad dog. It has been taken in crude filings, to the quantity of twenty grains, or more, for some time, without harm.

Besides the utensils and vessels made of this metal, it serves to preserve iron and copper; being extremely easy to melt, and, by means of any unctuous matter, adhering closely to them: it likewise serves in solders; amalgamated with mercury, it serves for the foiling of looking-glasses: by calcination it makes putty; which is of great use in the polishing of gems, and the making of enamels: it is a principal ingredient in pewter, as well as bell-metal: it mixes well with zink and regulus of antimony, and thus becomes whiter and harder; but too much regulus makes it brittle.

Being exposed on a tile to the focus of a burning-glass, it sends off a copious thick gross fume, leaving a fine, light, white calx behind, which, being continued longer in the focus, turns to thin, transparent, glassy strings; which melt no more, without the addition of an unctuous substance or charcoal; by this means it returns to tin. It dissolves with

with nitre: hence, perhaps, this metal consists of a copious sulphur, or particular bitumen, and a fine vitrifiable earth, mixed, on account of its poisonous quality, with a minute proportion of an arsenical salt.

Tin is soluble only in aqua regia; and a solution of it tinges a solution of gold with a beautiful purple colour.

OF IRON.

IRON is a very hard and sonorous metal; which, when polished, is of a shining colour, between white and livid; but, when unpolished, of a black colour. Iron is of two kinds, common and purified: this last is termed steel. No metal is so necessary for the uses of life as iron; nor is any metal found in so great quantities, almost in every country: it is dug out of the earth in very different forms. In some mines it is found pure, either granulated, or in lumps; in others it is met with in an heavy stone, of a dark yellow, or reddish colour; or in an heavy, yellowish, or red sand. Some ores yield the pure metal contained in them with little trouble, requiring only to be broken into small pieces, and melted
with

with charcoal in the space of a few hours; other ores require great labour to melt them; and also the addition of quicklime, marle, or stones, to facilitate the fusion. The melted metal is run into large moulds, and hardens into long thick masses: these masses are melted a second time; the flowing metal being continually stirred with an iron rod, and when hardened, it is beat with great hammers, till all the heterogeneous, vitrified, or burnt parts are separated, ignited, and then beat on the anvil with hammers. All iron is not, however, of the same goodness; the toughest is the best, and that which is most brittle of the least value. This difference does not proceed from the metal itself, but from the mixture of earthy and vitriolic parts.

Steel is made of iron by frequent fusion and purification; and in the iron of some mines this conversion is easily obtained; in others with more difficulty; and accordingly the ways of performing it are different. If the iron be very good it is melted with furnaces; and to the melted metal are added, gradually, equal parts of salt of tartar, or any other alkaline salt, filings of lead, and shavings of bullocks horns, the metal being kept continually

equally stirred. Afterwards the hardened mass is beat into small bars on an anvil.

Iron is the hardest of all metals, and steel is still harder and more rigid than iron, if, being ignited, it be thrown into cold water. Its specific gravity is to that of gold nearly as three to seven. Iron, long steeped in water, communicates to it a ferruginous taste, being dissolved by the water, and turned to a yellowish rust. This solution may be performed in a little time, if the iron be successively wetted with water, and then dried, for several times; but, if suffered to remain in the water without ever being dried, it is a long time before it is corroded. This makes it so difficult to preserve iron from rust; the best method however is to rub it over with some oily substance. Filings of iron laid in a heap, and sprinkled with water, will grow so hot as to set fire to sulphur, if the heap be large. By calcining iron in a reverberatory furnace, it is reduced to a calx of a dark red or purplish colour. When ignited in a strong fire till it be near melting, and then beat by the hammer, it throws off scales, which are nothing but half-vitrified iron. When it is melted in the refining furnaces,

naces, a part of it mixed with the charcoal, or other earthy parts, runs into scorizæ, which are a kind of glass. This metal is dissolved by all acids; but left untouched by alkaline salts. Filings of iron thrown upon any flame take fire, and emit green or red sparks.

Iron is the most useful of all metals for human life; for, beside the innumerable kinds of instruments made of it, it furnishes excellent remedies in many diseases. The medicinal virtues of iron, taken inwardly, were not unknown to the antients. Dioscorides attributes to it an astringent virtue, and recommends it in uterine hæmorrhages. He likewise orders wine, or water, in which a red-hot iron has been quenched, in the Cæliac passion, lientery, and dysentary, and for restoring weak stomachs. Physicians now acknowledge a twofold virtue in iron, one aperient, the other astringent. On these accounts it is reckoned the grand specific in hypochondriacal affections, and all kinds of chloroses. Some attribute an aperient virtue to some preparations of iron, and an astringent virtue to others; but the truth is, all these preparations are both astringent and aperient, though

though not in the same degree. For medicinal uses iron is preferable to steel.

OF COPPER.

COPPER is a reddish metal, easily tarnishing in a moist air, and contracting a green, or a blueish green rust. It is the most elastic and sonorous of all the metals, and the hardest of all except iron. It spreads with difficulty under the hammer, but may be extended to a great degree, drawn into fine wire, and beat into thin leaves. Its specific gravity is almost nine times greater than that of water. It requires for its fusion a strong white heat, greater than that in which gold and silver melt, though not so great as that which is requisite for the melting of iron. When melted, a little water thrown into it, causes it to move about with great violence, to the great danger of those who are near it.

Copper is not often found pure in the earth. There is a great variety of its ores, intermixed with different stony matters, generally abounding with sulphur, and sometimes containing a little arsenic. These ores are often of beautiful colours; blue, red, green, yellow.

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132. Of DIAMONDS.

The lapis lazuli, from which the precious blue pigment; called the ultramarine, is prepared, is one of the ores of this metal.

Ores of copper are to be found in almost every part of the known world; in France, Spain, England, Norway, Saxony, Bohemia; but more particularly in Sweden, Hungary, and Transylvania. Japan produces a sort of copper much superior to any that is met with in Europe.

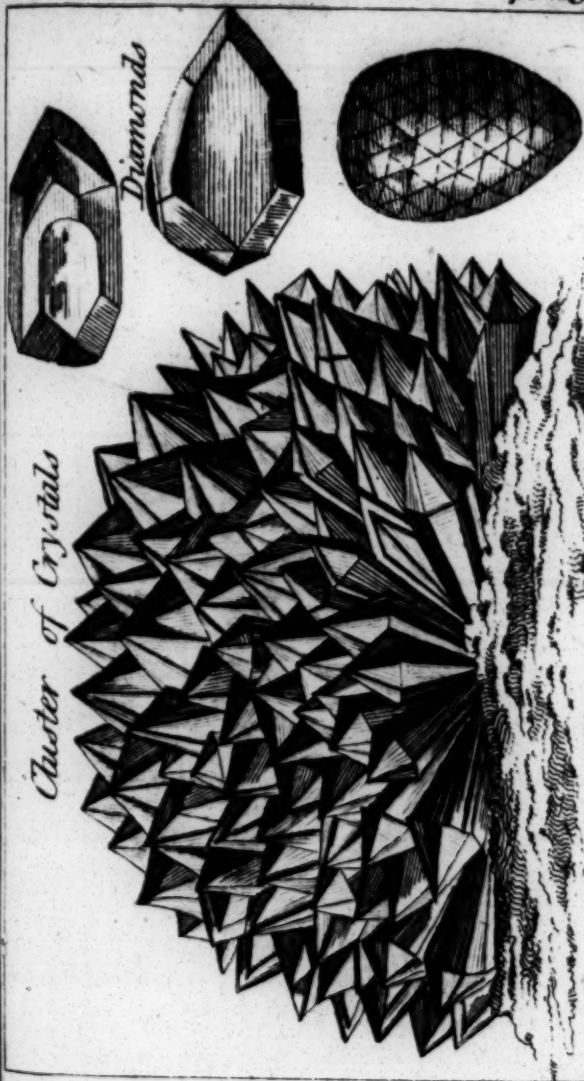
OF DIAMONDS.

THIS stone, though naturally colourless like the purest water, is eminently distinguished from all others of the colourless kind, by the lustre of its reflection. It is found sometimes of an annular, and sometimes in a pebble-like form. But, in whatever form the diamond is found, it is the same stone, and when polished has the same qualities in proportion to its perfection and purity. Like all other transparent fossils, the diamond is liable to be tinged by metalline particles; and is sometimes found with a cast of red, sometimes blue, sometimes green, and more frequently yellow. The

Cluster of Crystals

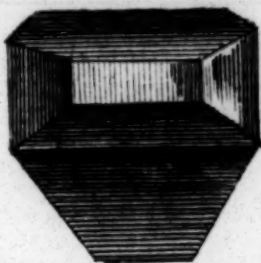


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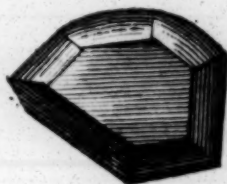
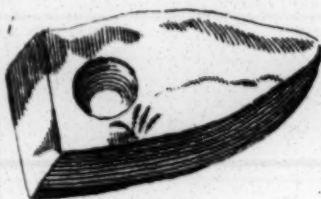


Cluster of Crystals





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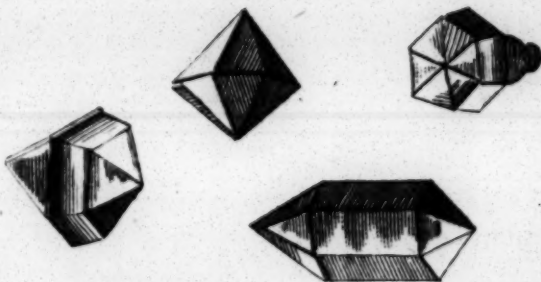


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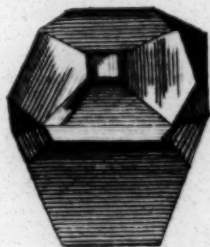


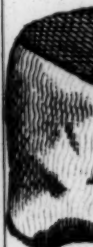


Rough Diamond



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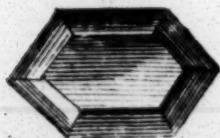




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small diamonds are the most plentiful, the others are found more and more rarely as they encrease in size.

In its native state, the diamond is sometimes bright, as if polished by art; but more frequently its surface is observed with foulnesses of various kinds; and sometimes it is, as the diamond-cutters term it, veiny, having certain points inconceivably hard on its surface.

The diamond will endure the force of the strongest fire unhurt, though ever so long continued in it, provided it be not removed too suddenly into the cold air, when it will sometimes crack. Exposed to the solar rays, collected in the focus of a large lens, it after some time splits into several very thin flakes, like those of talc; and these soon after run into a kind of glass, which has nothing of the hardness or lustre of the diamond.

The places whence we have the diamonds are the East Indies, in the island of Borneo, and in the kingdoms of Visapour, Golconda, Begal; and the Brasils, in the West Indies. The diamond is the hardest of all precious stones; it can only be cut and ground by itself, and its own substance.

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Diamonds

134 *Of the CARBUNCLE.*

Diamonds are cut and polished by means of a mill, which turns a wheel of cast-iron, sprinkled over with diamond-dust, mixed with oil of olives. The same dust, well ground, and diluted with water and vinegar, is used in the sawing of diamonds, which is performed with an iron or brass wire as fine as a hair.

A rose diamond, is that which is quite flat underneath, with its upper part cut in divers little faces, usually triangles, the uppermost of which terminates in a point.

A table diamond, is that which has a large square face at the top, encompassed with four lesser.

A brilliant diamond, is that cut in faces both at top and bottom; and whose table, or principal face at top, is flat.

OF THE CARBUNCLE.

THE carbuncle is an elegant gem, of a deep red, with a mixture of scarlet. It was known among the ancients by the name of anthrax. It is usually found pure and without blemish, and is as hard as the sapphire. It is naturally of an angular

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angular figure; and is found adhering by its base to a heavy and ferruginous stone of the emery kind: its usual size is about a quarter of an inch in length, and two thirds of that in diameter in its thickest parts. When held up against the sun, it loses its deep tinge, and becomes exactly of the colour of a burning charcoal; whence the propriety of the name which the ancients gave it. It suffers no alteration in the fire; neither parting with its colour, nor becoming paler by it. It is found only in the East Indies, and is not very common even there.

THE R U B Y.

THIS is a beautiful gem of a red colour, with a mixture of purple. In its most perfect and best-coloured state, it is a gem of extreme beauty and value. It is often found perfectly pure, and free from blemishes or foulness, but it is much more frequently greatly debased in its value by such blemishes and defects, especially in the larger specimens. It is equal in hardness to the sapphire, and second only to the diamond. It is various in size, but more regular in its shape

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than most of the other gems : its most common size is equal to that of the head of the largest sort of pins ; but it is found of four, eight, or ten carats ; and sometimes, though very rare, up to twenty, thirty, or forty. It is always found of a pebble-like figure, frequently roundish, sometimes oblong, and much larger at one end than at the other, and in some degree resembling a pear, though usually flattened on one side. In general it is naturally so bright, and pure on the surface, as to require no polishing ; and when its figure will admit of being set without cutting, it is often worn in its rough state, and with no other than its native polish.

We have the true ruby only from the East Indies ; and the principal mines of it are in the kingdom of Pegu, and the island of Ceylon. In Europe, we have crystals tinged to the colour of the ruby, but they have nothing of its lustre or hardness. The ruby seems to owe its colour to gold, it being possible to separate a small portion of gold from the little native rubies, and also to give the true colour of the ruby to fictitious paste by means of that metal.

THE

THE GARNET.

THIS is a very beautiful gem, of a red colour, with a mixture of blueish. When pure, and free from blemishes, it is not much inferior, in appearance, to the oriental ruby; though only of a middle degree of hardness between the sapphire and the common crystal. It is found of various sizes, from that of a pin's head, to an inch in diameter. Among our lapidaries and jewellers, genuine garnets are known by different names, according to their different degrees of colour. Being found in Europe, as well as the East Indies, garnets are distinguished into the oriental and occidental kinds. The oriental ones are principally brought from Calicut, Cananor, and Cambay; and the European ones are common in Italy, Hungary, and Bohemia.

THE AMETHYST.

THIS is a gem of a purple colour, resembling a violet, and sometimes fading to a pale rose colour. It is transparent and bright; and has its name from

a supposition that it prevented drunkenness: The best of these gems are met with in the East Indies, but they are very rare. Many are brought from America, but more from Bohemia. They are usually found in the form of large crystals, on the inside of large hollow stones. Sometimes these stones are found colourless, and they may at any time be made so by exposing them to the fire: in which pellucid, or colourless state, they so nearly imitate the diamond, that even jewellers are often deceived, as they require nothing but the hardness to render them equal to that gem. They are found of various sizes, and in various shapes, from the size of a small pea to an inch and half in diameter.

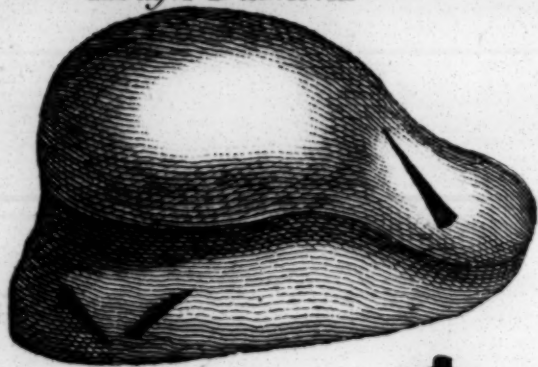
OF PEARL.

PEARL is a hard, white, shining body, usually roundish, found in a testaceous fish resembling an oyster. Pearls, though esteemed of the number of gems, and though they have been highly valued in all ages, proceed only from a distemper in the creature that produces them, analogous to the bezoars, and other stony concretions in several animals

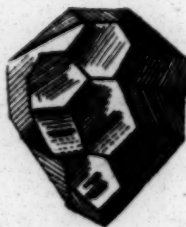
Diamonds Carats 279



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mals of other kinds ; and what the ancients imagined to be a drop of dew, concreted into a pearl in the body of the pearl-fish (which they supposed rose from the bottom to the surface of the water to receive it) is nothing more than the matter destined to form and enlarge the shell, bursting from the vessels destined to carry it to the parts of the shell it should have formed, and by that means producing these little concretions. The East Indian pearl-oyster is the fish in which these are usually produced. Tho' this article is not properly entitled to a place here, yet as it is looked upon as one of the gems, we could not omit mentioning it.

THE SAPPHIRE.

THIS is a pellucid gem, which, in its finest state, is extremely beautiful and valuable, and second only to the diamond, in lustre, hardness, and value. Its proper colour is a pure blue ; in the finest specimens it is of the deepest azure, and in others varies into paleness, in shades of all degrees between that and a pure crystal brightness and water ; without the least tinge of colour,
but

but with a lustre much superior to the crystal. They are thus distinguished into four sorts: the blue sapphire, the white sapphire, the water sapphire, and the milk sapphire. The finest are brought from the kingdom of Peru, in the East Indies; where some are found perfectly colourless, and others of all the shades of blue: these are all found in the pebble form. We have very fine sapphires too from Bisuagar, Conanor, Calicut, and the island of Ceylon, which are of all the shades of blue. In Ceylon, there are also found a sort of bastard gems, of a mixed nature between the sapphire and ruby. The occidental are from Silesia, Bohemia, and many other parts of Europe, but they are greatly inferior to the oriental both in hardness and lustre.

OF THE EMERALD.

THIS is the most beautiful of all the class of coloured gems, when perfect. It is sometimes found in the roundish or pebble form, sometimes in the columnar or crystalline form: the pebble emeralds, however, are the most valued. These are found loose in the earth

earth of mountains, and in the beds of rivers : they are, in their natural state, bright and transparent, though less glossy than the columnar ones. Both, however, are generally of a perfect and pure green. It has this green in all the different shades, from very dark to extremely pale, and is sometimes entirely colourless ; though the English jewellers then call it white sapphire. Emeralds are found in the East Indies, and in many parts of America, particularly about the gold mines of Peru : they are also met with in Silesia, Bohemia, and some other parts of Europe ; but they are very different in lustre and value as they come from these different parts. The oriental emeralds are of equal hardness with the sapphire ; those of Peru are of much the same hardness with the garnet ; and therefore of proportionably less beauty than the oriental. As to those of the several parts of Europe, they are not much harder than the crystal ; but when they are not harder than that stone, they are not properly called emeralds, but only crystals tinged green with copper, and are usually found in mines of that metal. These are very beautiful, but much inferior to the worst
of

of emeralds in hardness. The oriental emeralds are at present found only in Cambay, and are very scarce even there. Very few have of late been imported into Europe.

THE CHRYSOLITE.

THIS gem was known by the ancients under the name of the topaz; and the true chrysolite of the ancients, which had its name from its fine gold colour, is now universally called topaz by modern jewellers.

THE BERYL.

THIS is a precious stone, and is also called aqua marina, on account of its sea-green colour. It is chrystal, coloured with copper. It is transparent, and different pieces have different shades, even to yellow. Those which are gold-coloured are called the gilded beryl. The most beautiful aqua marina comes from the East Indies. The occidental ones come from Bohemia, Germany, Sicily, the isle of Elba, &c. and it is said that some of them are found on the borders of the Euphrates, and at the foot of Mount Taurus.

THE

THE ONYX.

THIS is one of the semi-pellucid gems, with variously coloured zones, but none of them are red; being composed of crystal, debased by a small mixture of earth, and made up of a number of flat plates, or of a series of coats, and separated from each other by veins of a different colour, resembling zones or belts.

THE AGATE.

THE agate is a precious stone, resembling the onyx in colour, but has no zones like those with which the onyx is decorated: instead of which the agate has lines or spots of various colours, so disposed as to represent the pictures of different objects; as woods, rivers, fruits, flowers, herbs, and clouds, but not very distinctly. The sizes are various, being sometimes only one inch in diameter, and sometimes eight inches. It is of a very firm, compact, and fine texture, though found in the shape of a stony pebble stone. The white veined agate, with delineations of trees and mosses,

mosses, is usually known by the name of the mocha stone.

OF THE JASPER.

JASPERS are of a complex irregular structure, of great variety of colours, and emulating the appearance of the finer marbles, or semi-pellucid gems. Their great characteristic is, that they all readily strike fire with steel, and make not the least effervescence with aqua fortis. The several kinds of nephritic stone, and the lapis divinus, or jade, are all genuine jaspers: but the hard, bright, green jasper of the East Indies, seems to be the true medicinal kind. It is found in masses of various sizes and shapes, but the common standard, as to size, is between four and five inches in diameter. It is generally simple and unmixed; but if it be in any degree variegated, it is always with white; and this is not disposed in streaks or veins, but in clouds. It is capable of a very fine polish, and when the white clouds are well disposed, is very beautiful. It is tolerably pellucid, when held up against the light, if the pieces are not too thick.

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OF SLATE.

THIS is a blueish fossil stone, very soft when dug out of the quarry, and therefore easily cut or sawed into long thin squares, to serve instead of tiles for the covering of houses, &c. Slate, smoothed and framed, is used in schools for youth to perform their operations in arithmetic, as the least moisture will obliterate any thing that may have been written on it by a pencil made of the same stone.

THE MAGNET.

LOADSTONE is a very rich iron ore, found in large detached masses, of a dusky iron grey, often tinged with brownish or reddish, and when broken appearing something like the common emery, but less sparkling. It is very heavy, considerably hard, of a perfectly irregular and uneven surface, and of a firm structure, but usually with some porous irregularities within. It is found in England, and all other places where there are iron mines.

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This famous stone was well known to the ancients, but scarce any other property of it than that of its attracting iron, as we may see in Pliny, b. 36. c. 16. However, it appears, that they knew something of its communicating virtue, particularly Plato, when describing that famous chain of iron rings put together, the first of which was held by a magnet; and Lucretius makes mention of the same magnetic quality operating through the hardest bodies.

The primary properties of the loadstone are the following: 1. Every loadstone has two points, called poles, which emit the magnetic virtue. 2. One of these poles attracts, the other repels iron, but no other body. 3. This virtue, being the third species of attraction, is communicated to iron very copiously by the touch, which renders it strongly magnetic. 4. A piece of iron so touched by the loadstone, and nicely suspended on a sharp point, will be determined to settle itself in a direction nearly north and south. 5. The end of the needle touched by the south pole of the stone will point northward, and the contrary. 6. Needles touched by the stone will dip below the horizon, or be directed on the

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touched part to a point within the earth's surface: this is called the dipping-needle. 7. This virtue may also be communicated to iron by a strong attrition all one way. 8. Iron rods or bars acquire a magnetic virtue by standing long in one position. 9. Fire totally destroys this virtue, by making the stone or iron red hot. 10. This power is exerted sensibly to the distance of several feet. 11. It is sensibly continued through the substance of several contiguous bodies or pieces of iron. 12. It pervades the pores of the hardest body. And, 13, equally attracts the iron in vacuo as in open air. These, and many more, are the properties of a body, not more wonderful than useful to mankind.

The power or force of magnets is generally greater in small than in large ones, in proportion to their bulk. It is very rare that very large ones will take up more than three or four times their own weight, but a small one is but tolerably good that will take up no more than eight, ten, or twelve times its weight.

Iron bars, by standing long in the same position, will acquire the magnetic virtue to a surprising degree. There has

been seen one about ten feet long and three inches thick, supporting the summer-beam of a room, which has been able to turn the needle at eight or ten feet distance, and exceeded a loadstone of three pounds and a half in weight. From the middle point upwards it was a north pole, and downwards a south pole; and Mr. Martin says he has now by him an iron rod, which has several poles or parts which change the position of the magnetic needle.

The poles of a loadstone are not to be looked upon as two such invariable points as never to change place; for, according to Mr. Boyle, the poles of a little bit of magnet may be changed by applying them to the more vigorous poles of another, as has been confirmed by Dr. Knight, who can change at pleasure the poles of a natural magnet, by means of iron bars magnetically impregnated. Upon gently cutting a magnet through the middle of its axis, each piece becomes a complete magnet; for the parts that were contiguous under the equator before the magnet was cut, become poles, and even poles of different names; so that each piece may become equally a north or south pole, according

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as the section was made nearer the south or north pole of the large magnet; and the same thing would happen in any other sub-divisions. But upon cutting a magnet longitudinally, there will then be four poles, the same as before the cutting; only that there shall be formed in each piece a new axis parallel to the former, and more or less in the inside of the magnet. We find by experience, that two magnets attract each other by the poles of different denominations; whereas, on the contrary, the two similar poles repel each other. By a great number of experiments we also learn, that the form of a magnet in attraction and repulsion reaches sometimes farther, sometimes not so far. The activity of some reaches to fourteen feet, and that of others is insensible within eight or nine inches; the sphere of activity is greater on certain days than on others, without its ever appearing that the heat, moisture, or drought of the air contribute any thing to this effect.

It has been found that the poles of the same denomination in magnets (and the case is the same in bodies magnetically impregnated) repel each other, while they are at a mean distance from the li-

mits of their sphere of activity, and on the contrary attract each other in the point of contact; there are other magnets that repel each other with greater vigour towards the middle of their sphere of activity than near the point of contact, where it seems the repulsion diminishes: yet Mr. Mitchel pretends to have observed, by means of artificial magnets, that the two poles attract and repel equally at the same distances, and in all kinds of direction; that the error of those who believed the repulsion to be weaker than the attraction was owing to this, that magnets and magnetical bodies are always weakened, by bringing the poles of the same denomination near each other; whereas their virtue is increased, when the poles of different denominations are brought near each other; that this augmentation or diminution of force, occasioned by the proximity of two magnets, becomes insensible, in proportion as they are removed from each other: for which reason we see, that at a great distance, attraction and repulsion approach more and more to an equality, and are reciprocally removed from equality, in proportion as the reciprocal distance of two magnets diminishes; so that if a magnet,

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magnet, which is pretty strong and pretty nigh to it, impair considerably a weak magnet that approaches it by the poles of the same denomination, it shall happen that the pole of this last shall be destroyed and changed into a pole of a different denomination, by means of which repulsion will be converted into attraction. In short, by many experiments, Mr. Mitchel was convinced, that attraction and repulsion increase and decrease in the inverse ratio of the squares of the respective distances of the two poles.

The magnet attracts iron with still greater force than it does another magnet; and this attraction extends to all bodies that contain ferrugineous particles.

The attraction of a magnet newly dug out of a mine, makes it take up only very small pieces of iron; for which reason it must be armed, in order to augment its force: besides this, the arming it unites, directs, and condenses its virtue towards its poles, and causes its emanations to tend entirely towards the mass which is laid thereon.

When you have determined where the poles are, which you may exactly find by placing over the magnet a very fine
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short needle, which will stand perpendicularly over each pole, and no where else; then you must file it very smooth at its poles, so that the axis shall have the greatest length, yet without too much diminishing its other dimensions. To determine the proportions of the armour, the greater the force of the magnet is, the thicker must the pieces of steel be of which it is to consist; and for this purpose try the magnet with several steel-bars, and the greater weight it takes up with a steel-bar on, that bar is to be its armour. Though the attraction of an armed magnet appears considerable, yet very weak causes destroy its effect in a moment; for instance, when an oblong piece of iron is attracted under the pole of an excellent magnet, and the pole of a different denomination in another magnet that is weaker is presented to the lower end of this piece of iron, this weaker magnet will very strongly take away the iron. In like manner, if the point of a needle be put under one of the poles of a magnet so as to hang by its head; and present to this head any bar of iron by its upper end, the needle will immediately quit the magnet, in order to adhere to the bar; but if the needle

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hold by its head to the pole of the magnet, then neither the bar of iron, nor a weak magnet shall disengage it; and there is another slight circumstance which makes an armed and vigorous loadstone appear to have no more force, and that is the too great length of the iron which is to be raised by one of the poles.

In order to communicate the magnetic virtue effectually, these methods are made use of. 1. It has been discovered, that iron, rubbed upon one of the poles of the magnet, acquires a great deal more virtue than from any other part thereof, and this is more considerable from an armed than a naked magnet. 2. The more gently the iron is pressed, and the more it is pressed against the pole, the more magnetical it becomes. 3. It is more convenient to impregnate iron on one pole than on both successively. 4. The iron is much better impregnated by pressing it uniformly, and in the same direction, according to its length, than by rubbing it by the middle; and the extremity, which touches the pole last, retains the most virtue. 5. A piece of polished steel, or a bit of pointed iron, receives more virtue than a simple piece of iron of the same figure; and *cæteris paribus*,

paribus, a piece of iron that is long, small, and pointed, is more strongly impregnated than that of any other form.

As several ways have been proposed for recovering the decayed virtue of load-stone, but to little purpose, especially that of keeping of the stone constantly in steel filings, we shall here relate the remarkable experiment of Mr. Haac for this purpose, as it was attended with great success. This gentleman had a magnet weighing fourteen ounces and a half, armed, which would take up sixteen times its own weight; but having laid it by for some years unused, it lost one fourth part of its virtue, or more; whereupon he hung as much weight to the stone as it would sustain, and so left it for some weeks; then returning, he applied more weight to the former, which it very easily bore, and then repeating the addition of more weight at several periods, in the space of about two years, he found that the stone had not only recovered its former strength, but increased it so far, that it would now take up more than twenty pounds, whereas at first it would not take up fifteen.

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OF MARBLE.

MARBLE is a genus of fossils, being bright and beautiful stones, composed of small separate concretions, moderately hard, not giving fire with steel. The colours of marbles are ranged in the following divisions. 1. Of the white plain marbles there are two sorts; the Parian marble of the ancients, and the statuary marble of the moderns, a bright and elegant sort; and the Carrara marble; a very fine marble, more compact and close than the former, but less bright. 2. Of the plain yellowish marble, there is but one sort; which is a hard, pale yellow and glossy marble, found in many parts of Italy. 3. There are many species of the blueish and black marbles, as the Chian marble, Basaltes, &c. 4. Of the plain green marble, there is but one kind, the Lacedemonian marble of the ancients. 5. The pale, or whitish brown, commonly called Derby marble. 6. The green marbles with shells. 7. The black Coralloide marble, with and without shells. 8. There are many species of the white variegated marble, as they are variegated with purple, blue, brown

156 Of ALABASTER.

brown, red, &c. 9. Of the brown variegated marbles there are also several sorts, some with red veins, and others veined with white, black, or brown. 10. Of the yellow veined and variegated marbles, some are veined with purple, and others with blue. 11. Of the black variegated marbles, some are veined with white, and others with blue, yellow, red, &c. 12. The green variegated marbles are also distinguished by the colour of their veins. 13. Of the grey spotted marbles, some are variegated with black, and others with green spots. 14. The red variegated marble is the Broccatello of the Italians, with white and gold veins.

OF ALABASTER.

ALABASTER is the name of a genus of fossils, nearly allied to marble: it is a bright elegant stone, and will receive a fine polish, but it is brittle. Naturalists enumerate several species of alabaster, as the snow-white shining alabaster. It cuts very freely, and is capable of a fine polish. There are very large strata of it in Arabia, Egypt, and many parts of Italy. Whitish yellow alabaster

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alabaſter is of a ſoft conſiſtence, and is called, by Boet, the phengites of Pliny, who affirms it was found in Capadocia. It is of a looſe open texture, and is conſiderably heavy. Beſides the places above-mentioned, alabaſter has been found in Germany, France, and Derbyſhire.

OF PORPHYRY.

THIS is a kind of a ſtone, of a plain uniform maſs, ſpotted with ſeparate concretions, of great hardneſs, and giving fire with ſteel. Porphyry is of ſeveral ſorts, as, 1. The porphyry of the ancients, which is a moſt elegant maſs, of a very firm and compact ſtructure, variegated, more or leſs, with pale red and white: its purple is of all degrees, from the claret colour to that of the violet, and its variegations are ſeldom diſpoſed in veins, but chiefly in ſpots, ſometimes very ſmall, and ſometimes running into large blotches. It is not ſo fine as many of the ordinary marbles, but it excels them all in hardneſs, and is capable of a moſt elegant poliſh. It is found in immense ſtrata in Egypt. 2. The hard red-lead-coloured porphyry, variegated with black, white,
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and green, is a most beautiful and valuable substance. It has all the hardness of the oriental porphyry, and greatly excels it in brightness, and in the beauty and variegation of its colours. It is found in great plenty in the island of Minorca, and is much superior to all the Italian marbles. 3. The hard pale-red porphyry, variegated with black, white, and green: this is of a pale flesh colour, often approaching to white. It is variegated in large spots or blotches, from half an inch to an inch broad. It takes a high polish, and emulates all the qualities of the oriental porphyry. It is found in immense quantities in Arabia Petræa, and is often met with in England, Ireland, and Germany.

THE GRANITE.

THIS is a distinct genus of stones, composed of separate, and very large concretions rudely compacted together, of great hardness, and capable of receiving a very beautiful polish. Of this genus there are three species: 1. The hard white granite, with black spots, commonly called moor-stone. It is much used in London for the steps of public build-

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buildings, and on other occasions, where great strength and hardness are required: 2. The hard red granite, variegated with black and white, and common in Egypt and Arabia. 3. The pale whitish granite, variegated with black and yellow. This is sometimes found in strata, but more frequently in loose nodules, and is frequently used for paving the streets.

OF FLINT, OR FLINT STONES

THIS is a semi-pellucid stone, composed of crystal, debased with earth, of one uniform substance, and free from veins: it is of different degrees of colour, according to the quantity of earth it contains, and naturally surrounded with a whitish crust. It is of an extremely fine, compact, and firm texture; and very various, both in size and figure. It is of all the degrees of grey, and from nearly quite black, to almost quite white. It breaks with a fine, even, glossy surface, is moderately transparent, very hard, and capable of a fine polish. It readily strikes fire with steel, and makes not the least effervescence with aqua fortis, and burns to a whiteness.

We frequently find on our shores, fine pellucid, flinty bodies, streaked or veined with white, black, brown, &c. These may be called the agates of this country, and answer to that gem in every particular but fineness.

The uses of flints, in glass-making, are two well known to require any particular recital. For the nicer operations in the glass trade, they are thus prepared: after freeing them from the white crust, in which they are usually inclosed, calcine them in a strong fire; then, powdering them in an iron mortar, sift the powder through a very fine sieve; pour some aqua fortis upon this powder, to dissolve any particles of iron it may have got from the mortar; then, after standing some time, let it be well washed with hot water, and dry it for use.

OF SAND.

SAND is a genus of fossils, the characters of which are, that they are found in minute concretions; forming together a kind of powder, the genuine particles of which are all of a tendency to one determinate shape, and appear regular, though more or less complete con-

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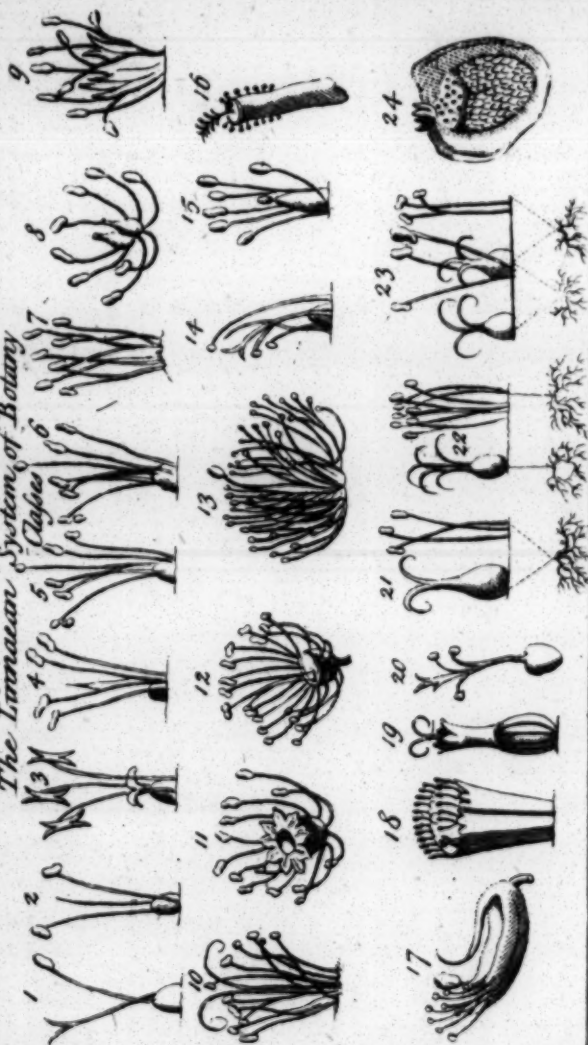
cretions ; not to be dissolved or disunited by water, or formed into a coherent mass by means of it, but retaining their figure in it ; transparent, vitrifiable by extreme heat, and not dissoluble in, nor effervescent with, acids. Sands are subject to be variously blended both with homogeneous and heterogeneous substances, as that of talcs, &c. and hence, as well as from their various colours, are subdivided into, 1. White sands, whether pure or mixed with other arenaceous or heterogeneous particles ; of all which there are several species, differing no less in the fineness of their particles, than in the different degrees of colour, from a bright and shining white, to a brownish, yellowish, greenish, &c. white. 2. The red and reddish sands, both pure and impure. 3. The yellow sands, whether pure or mixed, are also very numerous. 4. The brown sands, distinguished in the same manner. 5. The black sands, of which there are only two species, viz. a fine shining greyish black sand, and another of a fine shining reddish-black colour. 6. The green kind, of which there is only one known species, viz. a coarse variegated dusky green sand, common in Virginia.

Sand is of great use in the glass manufacture; the white writing sand being employed for making of the white glass, and a coarse greenish-looking sand for the green glass.

In agriculture, it seems to be the office of sand to make unctuous earth fertile, and fit to support vegetables, &c. For earth alone, we find, is liable to coalesce, and gather into a hard coherent mass, as appears in clay; and being thus embodied, and, as it were, glued together, is less disposed to nourish vegetables. But if such earth be mixed with sand, its pores are thereby kept open, and the earth itself loose, so as thus to give room for the juices to ascend, and for plants to be nourished by it. A vegetable planted only in sand, or in a fat glebe, or in earth, receives little growth or increase; but a mixture of both renders the mass fertile. In effect, earth is in some measure made organical by means of sand; pores and spaces, something analogous to vessels, being thereby maintained, by which the juices may be conveyed, prepared, digested, circulated, and at length discharged.

The Linnæan System of Botany

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OF BOTANY.

BOTANY is that branch of natural history, which treats of plants, their classes, subdivisions, various genera and species. The science of botany is differently explained by different authors; but the two systems of Tournefort and Linnæus more especially deserve our consideration. It is to be observed, that Linnæus has established a new system of botany, founded on the number and different structure observable in the male and female parts of generation of each plant; the former of which is called stamen, or stamina, when there are more than one of them; and the latter pistil.

Stamina, according to the generality of botanists, are the male organs of generation in flowers. Geoffrey and Linnæus explain the generation of plants in a manner analagous to that of animals, and maintain the use of the stamina to be that of secreting, in their fine capillary canals, a juice, which being collected, hardened, and formed into a farina, or dust, in the tips of the apices upon the tops of the pistil, whence is a
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passage for it to descend into the uterus, where, being received, it impregnates and fecundifies the plant. This doctrine, however, is opposed by some of the writers of the present age, and particularly by Dr. Alston, professor of botany at Edinburgh, who, in an express dissertation on the sexes of plants, undertakes to overthrow all the arguments in favour of the sexes of plants, by repeated experiments.

Pistil, as already observed, denotes the female organ of generation in plants: it consists of three parts, the germen, style, and stigma: the germen supplies the place of an uterus in plants, and is of various shapes, but always situated at the bottom of the pistil, and contains the embryo-seeds: the style is a part of various forms also, but always placed on the germen: and the stigma is also of various figures, but always placed on the top of the style, or, if that be wanting, on the top of the germen.

From the number and situation of the stamina, Linnaeus has arranged the whole family of plants under twenty-four classes.

1. The Monandria. 2. Diandria. 3. Triandria. 4. Tetrandria. 5. Pentandria. 6. Hexandria. 7. Heptandria.

dria. 8. Octandria. 9. Enneandria. 10. Decandria. 11. Dodecandria. 12. Icosandria. 13. Polyandria. 14. Didynamia. 15. Tetradynamia. 16. Monadelphia. 17. Diadelphia. 18. Polyadelphia. 19. Syngenesia. 20. Gynandria. 21. Monoecia. 22. Dioecia. 23. Polygamia. 24. Cryptogamia.

The monandria is a class of plants, with only one stamen or male part in each flower. To this class belong canna, &c.

The diandria is a class of plants comprehending all those with hermaphrodite flowers, and only two stamina on each; such are sage, olive, jessamin, rosemary, &c.

Triandria is a class of plants that comprehends all such plants as have hermaphrodite flowers, with three stamina, or male parts in each. To this class belong the tamarind, valerian, saffron, gladiol, iris, &c.

Tetrandia is a class of plants, comprehending all such plants as have hermaphrodite flowers, with four stamina, or male parts in each.

Pentrandia, one of Linnæus's classes of plants, comprehending those which have hermaphrodite flowers with five stamina

mina or male parts in each. To this genus belongs the vine, the elm, &c.

Hexandria, a class of plants, comprehending all those which have hermaphrodite flowers, and six stamina in each. To this class belong the narcissus, garlick, daffodil, lilly, &c.

Heptandria, a class of plants, comprehending those that have hermaphrodites flowers and seven stamina in each.

Octandria, a class comprehending those plants which have hermaphrodite flowers, and eight stamina or male parts in each.

Enneandria, a class of plants with hermaphrodite flowers, and nine stamina, or male parts in each. To this class belong the laurus, rheum, spondias, and butomos.

Decandria, a class of plants having hermaphrodite flowers with ten stamina in each.

Dodecandria, the eleventh order of plants, contains all those with hermaphrodite flowers, and eleven stamina in each: such are agrimony, asarum, &c.

Icosandria, a class of plants, the twelfth in order: the cup of the flower is monophyllous and hollow, with the corolla affixed by the unguis to its sides, and

and about twenty stamina inserted either into the side of the cup or the corolla. To this class belong the cactus or torch thistle, the amygdalus or almond-tree, the cherry, &c.

Polyandria, a class of plants, the thirteenth in order, with hermaphrodite flowers, and a large number of stamina, or male parts in each: these always exceed the number of twelve, and grow on the receptacle of the future seed.

Didynamia, a very comprehensive class of plants, and the fourteenth in order; the essential characteristic of which is, that there are four subulated stamina, inserted into the tube of the flower; two of which are shorter than the others, and placed together. To this genus belong baum, germander, lavender, thyme, betony, mint, basil, fox-glove, &c.

Tetradynamia, a class of plants whose flowers have four of their stamina of more efficacy than the rest: these are always known by having the four efficacious stamina longer than the rest.

Monadelphia, a class of plants, the sixteenth in order: the stamina of the flowers are so interwoven as to form one body. To this class belong the mallow, alcea, althæa, and hibiscus.

Dia-

Diadelphia, the seventeenth class of plants; comprehending all those with papilionaceous and hermaphrodite flowers, and leguminous seed vessels.

Polyadelphia, a class of plants, the eighteenth in order, whose stamina are connected together at their bases into several serieses.

Syngenesia, the nineteenth class of plants, according to Linnæus; so called because the stamina in these plants grow together, or are formed into a single regular congeres.

Gynandria, a class of plants, the twentieth in order; comprehending all those whose stamina are placed either on the style or the receptacle, elongated into the form of a style, and carrying on it both the pistil and stamina.

Monoecia, the twenty-first in order of Linnæus's class of plants; in which the male and female flowers are placed separately on the same plant, or rather on different stalks growing from the same root.

Dioecia, in the Linnæan system, is the twenty-second class of plants, comprehending all those which have the male and female parts of fructification, or the stamina and pistil on distinct plants of the

the same kind ; in which respect they bear some analogy to quadrupedes whose sexes are likewise distinct.

Polygamia, the twenty-third class of plants ; the characters of which are, that they have flowers of different structure ; some having male flowers, others female, and others hermaphrodite.

Cryptogamia, the twenty-fourth in order of Linnæus classes of plants ; the organs of fructification of which are either concealed within the fruit itself, or are so minute as to escape observation. To this genus belong the mosses, mushrooms, ferns, liver-worts, &c.

Such are the general classes of plants established by that excellent botanist, Linnæus ; who farther subdivides them into orders from the number of pistils, &c. The same celebrated naturalist has also distributed the vegetable part of the creation into different orders, from the form and structure of the calyx, or cup, of their flowers ; for the particulars of which we refer the reader to his *genera plantarum*.

Having thus briefly explained the system of Linnæus, we come to that of Tournefort, which is founded on the different structure and disposition ob-
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servable in the flowers, or, more strictly speaking, the flower-leaves of plants.

All plants are ranged, by Tournefort, under one or other of the following classes, viz. 1. Plants with monopetalous, campaniform, or bell-fashioned flowers. 2. Those with monopetalous, infundibuliform, or funnel-like flowers. 3. Plants with anomalous monopetalous flowers. 4. Plants with polypetalous labiated flowers. 5. Plants with polypetalous cruci-form flowers. 6. Plants with polypetalous rosaceous flowers. 7. Plants with polypetalous, rosaceous, and umbellated flowers. 8. Plants with caryophyllous, or pink-like flowers. 9. Plants with liliaceous, or lily-like flowers. 10. Plants with polypetalous, papilionaceous flowers. 11. Plants with polypetalous anomalous flowers. 12. Plants with flosculous flowers. 13. Plants with semi-flosculous flowers. 14. Plants with radiated flowers. 15. Plants with staminous flowers. 16. Plants without flowers, but having visible seeds. 17. Plants with neither visible flowers nor seeds. 18. Trees with apetalous flowers. 19. Trees with apetalous amentaceous flowers. 20. Trees with monopetalous flowers.

Tournefort's System of Botany

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ers. 21. Trees with rosaceous flowers.

22. Trees with papilionaceous flowers.

The most eminent botanists among the ancients were Hippocrates, Theophrastus, Dioscorides, Pliny, Galen, &c. In the sixteenth century, the ancient botany was revived by Leoniceus, Brasavolus, Cordus, Fuchsius, Mathiolus, Dalechampius, &c. They were soon after joined by others, and, by their industry, botany was first reduced into a body, or system; as Gesner, Dodonæus, Cæsalpinus, Clusius, Lobel, Columma, Prosper Alpinus, the two Bauhins, Plunket, Bucconi, &c. These were succeeded by others, who have laboured successively to bring the science of botany still nearer to perfection. Among these are Morrifon, Malpighi, Hermannus, Ray, Magnol, Tournefort, Sloane, Sherrard, Boerhaave, Linnæus, and many others.

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